Initial Environmental Examination

June 2023

Bangladesh: South Asia Subregional Economic Cooperation Dhaka-Northwest Corridor Road Project, Phase 2 - Tranche 3

Hatikamrul - Rangpur Road

Volume 2 of 10, Chapter VI- References

Prepared by Roads and Highways Department, Government of Bangladesh for the Asian Development Bank.

CURRENCY EQUIVALENTS

(As of 02 June 2023)
Currency unit – Bangladeshi Taka (Tk)
Tk 1.00 = $ 0.0093
$ 1.00 = Tk 107.50

ABBREVIATIONS

AADT	Annual Average Daily Traffic
AAQ	Ambient air quality
AAQM	Ambient air quality monitoring
ADB	Asian Development Bank
AH	Asian Highway
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BOD	Biochemical oxygen demand
BOQ	Bill of quantity
BUET	Bangladesh University of Engineering and Technology
CITES	Convention on International Trade of Endangered Species
COD	Chemical oxygen demand
CSC	Construction Supervision Consultant
DO	Dissolved oxygen
DPR	Detailed project report
EA	Executing Agency
ECC	Environmental Clearance Certificate
ECR	Environmental Conservation Rules
EHS	Environment Health and Safety
EMOP	Environment Monitoring Plan
EMP	Environment management plan
IEE	Initial Environment Examination
EHS	Environment Health and Safety
GHG	Greenhouse gas
GIS	Geographical information system
GOB	Government of Bangladesh
GRC	Grievance redress committee
GRM	Grievance redress mechanism
HFL	Highest flood level
IA	Implementing Agency
NOx	Oxides of nitrogen
PAP	Project Affected Persons
PCU	Passenger Car Units
PD	Project Director
PIU	Project Implementation Unit
PM	Particulate Matter
PPE	Personal protective equipment
PPTA RHD	Project Preparedness Technical Assistance Roads and Highways Department

RRTC	Road Research and Training Centre
SASEC	South Asia Subregional Corridor
SO2	Sulphur Dioxide
SPM	Suspended Particulate Matter
SPS	ADB Safeguard Policy Statement, 2009
TA	Technical assistance
TDS	Total dissolved solids
TSS	Total Suspended Solids

WEIGHTS AND MEASURES

dB(A)	–	A-weighted decibel
ha	–	hectare
km	–	kilometre
km^2	–	square kilometre
KWA	–	kilowatt ampere
Leq	–	equivalent continuous noise level
µg	–	microgram
m	–	meter
MW (megawatt)	–	megawatt
PM 2.5 or 10	–	Particulate Matter of 2.5 micron or 10-micron size

NOTE

In this report, "$" refers to US dollars.

VI. CLIMATE CHANGE ASSESSMENT

A. Greenhouse Gas Emission

342. GHG emission likely to be generated from the project roads have been computed using the Transport Emissions Evaluation Model for Projects (TEEMP)[13] developed by Clean Air Asia[14], the Institute for Transportation and Development Policy and with funding from ADB. TEEMP is an excel based tool to assess the equivalent CO_2 gross emissions without (business as usual or BAU) and with the project improvements (with project scenario or WPS). The main improvement from the project that was considered for the model are better surface roughness with less than 2.5m/km, and widening of project road from 2 lanes to 4 lanes. These were translated into increase in traffic speed and hence fuel consumption. The model has also been used for CO_2 emission assessment during construction stage. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes and volume/capacity saturation limit. The model also computes for emission and emission intensity of PM and NOx.

343. Few assumptions were made in this software:

i. Fuel efficiency as reckoned in business as usual (BAU) and with project scenario (WPS) is given in Table 42. It is assumed that the fuel efficiency of the vehicles would increase due to improvement of the roads.
ii. It is assumed that there would be no or minimum number of vehicles with vintage year before 2000 using Euro–I fuel type after 20 years (Table 43). Pre Euro vehicles are assumed to be completely discarded for vehicle categories except for 3 wheelers.

Table 42: Fuel efficiency in km/l

Scenario	2017			2036		
	Petrol	Diesel	LPG	Petrol	Diesel	LPG
2-Wheeler	50.00			50.00		
3-Wheeler	30.00	20.00	30.00	30.00	20.00	30.00
Car	15.00	18.00		11.00	18.00	
Multi-axle		8.00			8.00	
Bus		6.00			6.00	
2-axle		8.00			8.00	

Table 43: Fuel efficiency in km/l

Vehicle Type	Current Scenario				Post 20 Years		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
2 Wheeler		20%	80%		20	60%	20%
3 Wheeler	100%					50%	50%
Car			20%	80%		20%	80%
Multi-axle		10%	20%	70%	10%	20%	70%
Bus		10%	20%	70%	10%	20%	70%
2-axle		10%	20%	70%	10%	20%	70%

[13] TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects
[14] A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors

344. The model requires basic information and parameters from the project such as the type of road (expressway, rural or urban road), number of sections to be assessed, project's useful life, induced traffic elasticity, and maximum passenger car units (PCUs). TEEMP also requires physical details (lane width, lane length, number of lanes and roughness coefficient); traffic and trip details per section (average traffic volume per day, average trip distance, % share of local traffic, and trip distance for local trips); and fleet details (% breakdown of vehicles per fuel type, fuel efficiency at 50 kph, % breakdown of different vehicle fuel types by Euro standards, PCU equivalent of different vehicles, occupancy and loading factors).

345. Traffic forecasts were taken from Detailed Project Report and is shown in Table 44. The corresponding growth rates for different vehicle types are indicated in Table 45.

Table 44: Annual Average Daily Traffic (AADT) for Hatikamrul-Rangpur Road

Section[15]	Vehicle Type	2017	2020	2025	2030	2036
1	2-Wheelers	867	1,055	1,464	2,032	3,010
	3-Wheelers	415	506	701	973	1,442
	Car	445	542	752	1,043	1,546
	Multi-axle	638	777	1,078	1,496	2,217
	Bus	4,782	5,821	8,077	11,207	16,602
	2-axle	7,929	9,651	13,391	18,580	27,526
2	2-Wheelers	3,337	4,061	5,635	7,819	11,583
	3-Wheelers	1,232	1,500	2,081	2,887	4,278
	Car	442	538	747	1,036	1,535
	Multi-axle	630	767	1,064	1,476	2,187
	Bus	3,557	4,329	6,006	8,334	12,347
	2-axle	6,054	7,369	10,224	14,186	21,017
3	2-Wheelers	5,081	6,185	8,581	11,907	17,640
	3-Wheelers	867	1,055	1,464	2,032	3,010
	Car	553	673	934	1,296	1,920
	Multi-axle	649	790	1,096	1,521	2,254
	Bus	2,929	3,565	4,946	6,863	10,167
	2-axle	4,348	5,292	7,343	10,188	15,094

Table 45: Normal Traffic Growth Rates for Different Category of Vehicles

Period	2-Wheelers	3-Wheelers	Car	Multi-Axle	Bus	2-Axle
2017~ 2019	4.70%	7.48%	7.48%	7.48%	7.48%	7.48%
2020 ~ 2024	4.82%	7.74%	7.74%	7.74%	7.74%	7.74%
2025 ~ 2029	4.82%	7.74%	7.74%	7.74%	7.74%	7.74%
2030 ~ 2034	4.82%	7.74%	7.74%	7.74%	7.74%	7.74%
2035 ~ 2036	4.82%	7.74%	7.74%	7.74%	7.74%	7.74%

[15] Section 1- Hatikamrul – Bhuyangati; Section 2 – Between Kashipur (Mokamtola) – Gobidagonj, Pakurtala (Km 243.512); Section 3 – N5-51, Between Mithapukur – Rangpur Modern More, Pairabond (km 316.066)

346. Input parameters as considered for all the project roads are as given in Table 46. Design period is considered to be 20 years and volume capacity saturation limit is considered based on the current traffic velocity and is considered as 2.0 for the entire project road.

Table 46: Input Parameters for TEEMP

No.	Particular	BAU	WPS
1	Lane width (m)	3.5	3.65
2	Lane length (km)		
	Section 1	66.6	66.6
	Section 2	70.5	70.5
	Section 3	19.8	19.8
3	Number of lanes	2	4
4	Roughness (m/km)	6	2.5
5	Induced Traffic		0.2
6	Start of Assessment Year	3	3

347. Maximum PCU for 2 and 4 lanes were considered as 36,000 and 80,000, respectively. In the absence of emission factors data for vehicles in Bangladesh, emission factors were mostly taken from the CPCB/ MoEF&CC, India (2007) Draft Report on Emission Factor Development for Indian Vehicles, The Automotive Research Association of India, and C. Reynolds et.al (2011) Climate and Health Relevant Emissions from in-use Indian three-wheelers rickshaw as presented in Table 47.

Table 47: CO2 Emission Factors for different vehicle types

Vehicle Type	CO_2 Emission Factor (kg/L)	
	Gasoline	Diesel
2-Wheel	1.37	
3-Wheel	2.12	2.63
Cars	2.24	2.59
Multi-axle		3.21
Bus		3.61
2-axle		3.50

348. It was assumed that 2-wheelers average 5 km and 3-wheelers average 10 km for Sections 1 and 2, and 3 km for both 2 and 3-wheelers for Section 3. All other types of vehicles were assumed to cover the whole road segment. Furthermore, 2-wheelers and 3-wheelers constitute 90% each of the total local traffic, whereas car, multi-axles, bus and 2-axles constitute 40% respectively of the total local traffic.

349. Emissions from road construction were estimated by using the emission factor for rural/urban roads, by using ADB Carbon footprint 1(http://www.adb.org/documents/reports/ estimating-carbon-footprints-road-projects/default.asp), which is equivalent to 48,400 kg CO_2/km of road construction.

350. The proposed road widening and upgrading resulting to surface roughness and road capacity improvements have implications in CO_2 emissions. Improved roughness results to higher speed and lesser emissions while increase in vehicles in the new road increases emissions. These factors are further affected by traffic congestion once the volume/capacity saturation limit was reached.

351. The project road section-wise CO_2 emission intensity is provided in Table 48. The design life of the road is 20 years. Total CO_2 emission at business-as-usual, project without induced traffic, and project with induced traffic were estimated as 22,862,356 tons, 10,627,776 tons, and 13,559,956 tons, respectively. CO_2 emission from construction phase was estimated at 1,726 tons.

352. Emissions from PM and NOx were likewise shown in Table 48. PM and NOx emissions are higher during with project scenario, as a result of more vehicles using the road compared to the BAU scenario.

Table 48: Output and Output Intensity of CO2, PM and NOx

Parameters	GHG / Pollutants	Project Scenario		
		BAU	WPS (without induced traffic)	WPS (with induced traffic)
Output (tons)	CO_2	22,862,356	10,627,776	13,559,956
	PM	2,205	2,396	2,851
	NOx	76,812	83,504	99,342
Output Intensity (tons/year)	CO_2	1,143,117.78	531,475.11	678,084.07
	PM	110.25	119.81	142.53
	NOx	3,840.62	4,175.22	4,967.08

353. In terms of intensity, total CO_2 emissions at business-as-usual, with-project (without induced traffic) and with project (with induced traffic) scenarios were estimated at 1,143,117.78 tons/year, 531,475.11 tons/year and 678,084.07 tons/year, respectively. These values are significantly above the 100,000 tons CO_2e/year threshold[16] set in ADB SPS 2009. ADB requires the borrower (the Government of Bangladesh through the Roads and Highways Department) to evaluate feasible and cost-effective options to reduce or offset project related greenhouse gas emissions.

B. Climate Change Risks and Vulnerabilities

354. The Bangladesh Climate Change Strategy Action Plan[17] (BCCSAP 2009) recognizes that climate change will exacerbate many of the current problems and natural hazards the country faces. It is apprehended that climate change will lead to: increasingly frequent and severe tropical cyclones, with higher wind speeds and storm surges leading to more damage in the coastal region; heavier and more erratic rainfall during the monsoon season resulting in: higher river flows, causing over-topping and breaching of embankments and widespread flooding, severe river bank erosion and increased sedimentation.

355. Review of findings from other published and online available literature on climate change in Bangladesh indicate risks and vulnerabilities due to changes of temperature, rainfall, temperature and rainfall related extreme events, cyclones, floods, and sea level rise. Climate change in Bangladesh is likely to result in: (1) higher annual precipitation and daily temperature; (2) greater temperature and rainfall extremes; (3) increased flooding, both in terms of extent and frequency; (4) increased cyclone and storm surges both in terms of extent and frequency; (5) low

[16] Page 38, Appendix I, footnote 10 of SPS 2009.

[17] A publication by Ministry of People's Republic of Environment and Forests, Government of the Bangladesh, Sep. 2009; http://www.climatechangecell.org.bd/Documents/climate_change_strategy 2009.pdf.

river flow during dry periods; and (6) sea level rise and increased salinity intrusion.[18]18 Similarly a working paper[19] by World Bank cites Bangladesh as one of more "potential impact hotspots" threatened by, "extreme floods, more intense tropical cyclones, rising sea levels and very high temperatures".

356. **Precipitation.** Although various literature sources have differing projections on precipitation, yet all agree to an increased intensity and frequency. Spatial pattern of average annual rainfall shows that rainfall is significantly increasing in all regions of Bangladesh. Trend analysis of wet and dry months in Bangladesh show that the number of wet months is increasing and the number of dry months is decreasing in most parts of the country. Heavy rainfall days (>200mm/day) in Bangladesh have increased significantly by an amount of 1.2 days/decade. This leads to say that the increased severe monsoon wet months can trigger more rain related flooding throughout Bangladesh.

357. **River Water Level and Flooding.** The frequency of abnormal floods in Bangladesh has increased substantially in the past decade. By the trend in flood events in last fifty-five years in Bangladesh, it has been indicated that flood severity and frequency has increased in the spatial as well as depth of inundation in Bangladesh.

358. **Temperature.** An increase of mean temperature of Bangladesh by 0.097°C/decade has also been observed at 95% level of confidence in the last fifty years. Climate models estimate a steady increase in temperature for Bangladesh and predict an average increase of temperature of 1.4°C in 2050 and 2.4°C in 2100. The trends in number of hot days (maximum temperature >30°C) and heat wave frequency (consecutive three days with maximum temperature greater than the 90th percentile) for the time period 1958-2007 increased by 1.16 days/year at 99% level of confidence (Shahid 2010d).

359. **Tropical Cyclones.** In the past century (1901–2000), the rate of tropical storms striking the Bangladesh coast was one storm per year. Since 1950, the rate of land falling tropical storms has increased by 1.18 per year. A hydrodynamic model predicts more intensified surge heights at the coasts of Bangladesh due to climate change. They also predicted that flooded area, flooding depth and surge intrusion length will be substantially larger under intensified surge conditions.

360. **Sea Level Rise.** It has been reported that the sea level in the coastal region of Bangladesh will increase by about a meter by 2100 (World Bank 2000). The 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) projected that global mean sea levels would rise by 18 – 59 cm above 1990 levels by the 2090s (where the lower bound corresponds to the lower estimate for the lowest emissions scenario, and the higher bound corresponds to the upper estimate for the highest scenario).

361. **Salinity in River Water.** A study on changes in salinity of coastal rivers between 1967 and 1997 by the Soil Resources Development Institute (SRDI, 1998) shows that salinity in some parts of the coastal region of Bangladesh has increased by 124% in the last 30 years. One of the major impacts of sea level rise on water resources will be the reduction of fresh water availability by salinity intrusion. It is reported that the reduction in rainfall and low river flow during the dry season may aggravate the salinity levels in the coastal rivers of Bangladesh.

[18] Vulnerability of the power sector of Bangladesh to climate change and extreme weather events; Regional Environmental Change, 12(3): 595-606, Shahid, S. (2012)
[19] http://climatechange.worldbank.org

C. Climate Change Adaptation Measures

362. **Design Flood Level.** As a structural measures, to counter the increase in flood levels due to the effects of climate change, the design flood level incorporates an adaptation allowance of 0.37 m above limits generated by general engineering considerations.

363. **Road Embankment.** The design of the road embankment of the Hatikamrul – Rangpur road project has taken into consideration an additional 102.4 cm increase from the existing road surface. This corresponds to a freeboard of 0.9 to 1.0 m (depending on the road stretches) above the existing road surface and is consistent with the 2011 hydrological study, where an extreme value analysis HFL plot for a 50-year flood frequency was estimated to be about 0.85 m above the 20-year HFL.

364. **Bridge Design.** As an adaptation measure recommended by the IEE reports, the design of bridges in the project area advocates a 37 cm increase from existing HFL in line with the envisaged increase in flood level under a changed future climate. The climate change adaptation concept for bridges in the project area thus takes the bridge design to protect against a 1 in 50 year flood (i.e. 2% chance of occurrence of a 50-year flood magnitude in any given year).

365. **Drainage Capacity Design.** As adaptation measure, the proposed road incorporates longitudinal drains along the total highway length, increase the number of cross drainages per unit distance and replace existing pipe culverts with box culverts that provide larger discharge openings.

366. **Construction Materials Policy Adaptation.** The Government of Bangladesh has recently adopted a policy to encourage construction of roadway embankments with river sand rather than clayey agricultural soil. River sand is a good fill material with higher California Bearing Ratio (CBR) value. The IEE reports point that river sand is quite abundant in the various riverbeds in the project area. Sand is easily compactable to a high degree of compaction but will require protection against erosion by cladding with a layer of cohesive soil. The design of embankments for new carriageways on these sub-projects have based on the use of river sand with a CBR value estimated as 10% or greater than clayey agricultural soil.

367. **Adaptation to High Temperature.** It is well known that rutting is one of the main distresses in the asphalt pavements under the action of heavy traffic and high road surface temperatures, followed by cracking under the action of UV radiation. Climate models estimate a steady increase in temperature for Bangladesh and predict an average increase of temperature of 1.4°C in 2050 and 2.4°C in 2100. The trends in number of hot days (maximum temperature >30°C) and heat wave frequency (consecutive three days with maximum temperature greater than the 90th percentile) for the time period 1958-2007 increased by 1.16 days/year at 99% level of confidence.

D. Climate Change Adaptation Costs for Hatikamrul – Rangpur Road

368. . Since there are enough evidences that climate change will modify actual risk levels and therefore challenge design guidelines and procedures for the operation and maintenance of the road infrastructure, a budget of $45.9 million was allocated for engineering measures as climate change adaptation costs. These cover increase in road embankment height by 37 cm for 157 km length of the Elenga-Hatikamrul road; increase in bridge height by 37 cm for 17 bridges with a total length 1,113 meters; addition of new box culverts and replacing pipe culverts with box culverts; installation of longitudinal drainage system to quickly drain out the water for heavy rainfall; and improvement of subgrade as drainage layer to lessen the deterioration of the road base.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. General

369. This section describes an Environmental Management Plan (EMP) for the Hatikamrul-Rangpur road project. It aims to provide environmental management guidance by delineating compliance requirements, accountabilities and performance objectives, and contains practical recommendations to reduce the potential environmental impacts which may occur as a result of the project activities. Since, HR road project is comprised of development of existing 156+900 km road which has both positive and negative environmental impacts at the pre-construction, construction and operational period. Potential negative impacts of the project as per the Initial Environmental Examination (IEE) ratings are classified as insignificant, moderate and significant; localized or widespread and temporary or persistent. It is, therefore, necessary to manage the environmental issues timely with proper manner with the help of Environmental Management Plan (EMP) in compliance with the ADB safeguard policy statement 2009 and Department of Environment (DoE) environmental guidelines. The purpose of this EMP is to protect the environmental values of the project areas by facilitating mitigation measures and management plan of potential adverse impacts arising from the project implementation.

B. Objective of EMP

370. The EMP is necessary on the grounds that it will manage the environment by off-setting the negative impacts with possible mitigation measures and enhancing the positive impacts within the allocated fund from the project. Thus, the main objectives of the EMP for the construction of the Hatikamrul-Rangpur road project are:

(i) Define the responsibilities of the project proponents in accordance with the three project phases (design, construction and operation);
(ii) Facilitate the implementation of the mitigation measures by providing the technical details of each project impact, and proposing an implementation schedule of the proposed mitigation measures;
(iii) Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
(iv) Identify training requirements at various levels and provide a plan for the implementation of training sessions;
(v) Identify the resources required to implement the EMP and outline corresponding financing arrangements; and
(vi) Providing a cost estimate for all proposed EMP actions.

C. Environmental Management Plan (EMP)

371. On the basis of identification of the environmental impacts and recommended mitigation measures linked with the Hatikamrul-Rangpur project activities, an EMP has been prepared which will be followed at the construction and operation stages. While preparing the EMP, medium and significant impacts are taken into consideration to recommend possible mitigation measures. A mitigation measure considered as successful when it complies with the Environmental Quality Standards (EQS), policies, legal requirements set by ADB SPS, 2009 and DoE environmental guidelines and other relevant GoB legal requirements. The necessity of updating the EMP, because the previous EMP prepared in 2017 which is quite old and many variations are proposed. Furthermore, topography of some areas have also been changed due to construction of culvert, bridge, flyover, drainages, SMVT lane, Bus bay and others. To manage environmental degradation due to variations in designs structures and volume of construction activities updating of EMP with corresponding mitigation measures and supervision is important. Table 49 provides the EMP with

relevant changes in environmental issues to be generated due work variations and corresponding mitigation measures for diligent implementation.

Table 49: Environmental Management Plan for Hatikamrul-Rangpur Road

EMP Code[20]	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
DESIGN/PRE-CONSTRUCTION STAGE								
P01EMP	Topography	▪ Change in topography due to construction-related structures such as bridges, embankments, etc.; and ▪ Visual changes to topography.	Provision for tree plantation in the design (see Appendix G for tree plantation plan).	Transport route and worksite cleared of any dust/mud	Compliance with National guideline for land use policy.	Throughout the project areas	Design Consultants (DC)	RHD
P02EMP	Removal of Trees	Cutting of 105339 trees of different species.	▪ Minimize the tree cutting by selecting road widening option based on technical and tree laws consideration. ▪ Trees should not be cut prior the permission from Forest Department. ▪ Afforestation shall be done at the ratio of 1:2 ▪ A total of 215000 sapling trees will be planted (see Appendix G for tree plantation plan). ▪ For social forestry afforestation ratio shall	No of tree felled; No. of afforested seedlings; No. of indigenous tree species planted; Compensatory plantation site identified	Compliance with guidelines on tree cutting and afforestation from the Forest Department	Throughout the project areas	DC	RHD

[20] P- Pre-construction; C – Construction; O - Operation

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			be as per the consultation with tree owner. ▪ Raised Median will be planted with grasses and shrubs which may not attain height more than two meters. This planting could provide an effective protection against night glare besides beautifying the area; ▪ The compact plantation will be done on both sides; ▪ The indigenous trees most suited to the tract will be planted; ▪ If a tree of rare species is growing within the ROW and is required to be removed, it will not be felled but uprooted and transplanted in close consultation with the Forest Department; ▪ An awareness campaign targeted on the neighbourhood farmers will be carried to popularize the planting of trees, and saplings should be					

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			provided on subsidized costs					
$P03_{EMP}$	Land Acquisition	▪ Loss of 184.43 hectares of land of different types; ▪ Resettlement of Affected Persons (APs).	▪ All efforts shall be made in finalization of alignment to reduce productive land requirement ▪ Careful alignment and route selection by the designer to minimize resettlement; ▪ Developing proper judicious compensation package for affected persons; ▪ Prior to site works, payment of fair compensation to affected people based on the Land Acquisition and Resettlement Plan shall be made.	Land substitution Cash compensation of properties acquired.	Compliance with Resettlement Plan	Throughout the project areas	RHD/DC	RHD
$P04_{EMP}$	Loss of Structures (Dwellings, Commercial Buildings and Industrial Structures)	▪ A few numbers of homesteads have to be acquired throughout the road alignment. ▪ Some markets and shops will	▪ Need to compensate for the loss of land, house, trees, structures, crops, wage income etc. ▪ To ensure similar or better living conditions for project affected persons (PAPs).	Number of public grievances re-resettlement and compensation; Number of complaints from sensitive receptors	Compliance with Resettlement Plan	Throughout the project areas (Refer to Table 4.15 and Appendix E)	RHD/DC	RHD

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		also be relocated.						
P05$_{EMP}$	Educational Institution, Religious Structure, Culturally Sensitive Structures	Educational, religious, and cultural institutions in the PIA will be directly and indirectly affected from the project activities.	▪ The project implementation should take in to consideration construction of the alignment or making provision of allocating alternative land and financial resources (for rehabilitation of the Madrasah, Mosque and the educational institution falling within the alignment). ▪ Provision should be made of, at least, two rows of trees along the RoWs of the alignment and suitable noise barriers to absorb the noise and vibration to be caused by vehicle movement.	Records of chance finds Temporary access provision; Permanent access restored	Compliance with Resettlement Plan	Throughout the project areas. (Refer to Table 4.15 and Appendix E)	RHD/DC	RHD
P06$_{EMP}$	Public Utility	Inconvenience caused by disruption of public utilities	▪ Provision in the design and budget for the relocation of the existing utility infrastructures wherever required; and ▪ All public utilities (e.g. water pipes, power/ telephone lines likely to be affected by the	Number of complaints from sensitive receptors Nos of electric poles relocated; Temporary power supply	Compliance with Resettlement Plan and Emergency Response plan	Throughout the project areas	RHD/DC	RHD

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			proposed project road expansion will be relocated well ahead of time before the actual commencement of the construction work.					
P07$_{EMP}$	Legal permits and clearance	Taken from the GoB and local authorities	Obtain all necessary consents, permits, environmental clearances, etc. from concerned authorities like DOE, FD, BIWTA, DC office and other concerned stakeholders and authorities before the start of civil works.	Records of chance finds Temporary access provision; Permanent access restored	Compliance	Throughout the project areas	RHD/DC	RHD
CONSTRUCTION STAGE								
C01$_{EMP}$	Hydrologic Regime	▪ Temporary drainage blockage, especially at small bridges, culverts, service areas, and construction sites. ▪ Increased flood risk from more rapid and higher levels of runoff	▪ Provision of drains to take design flows; ▪ Wastes should not be disposed near any water body. All waste depending on its characteristics, should be disposed of in a controlled manner.	Designs of both Cross and side drains; No of culverts; Number and size of pipes	Compliance with Design report	Bridge and culvert sites	Contractor	RHD / Supervision Consultants (SC)

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
$C02_{EMP}$	Drainage	▪ Drainage congestion due to waste/sediment disposal and construction of road embankment;	▪ Regular cleaning of channels to avoid choking.	Designs of both Cross and side drains; Number of culverts; Number and size of pipes	Compliance with Design report	Drainage structure sites	Contractor	RHD / SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		▪ Erosion and subsequent deposition in the adjacent crop fields.						
C03$_{EMP}$	Soil Erosion and Siltation	▪ Soil erosion due to construction activities, earthworks, cut and fill operations and from stockpiles	▪ Adopt good construction practices. ▪ Replanting with native varieties of trees and shrubs ▪ Construction schedule for bridges during non-monsoon season. ▪ Turfing of embankments to protect slopes. ▪ Earth stockpiles to be provided with gentle slopes ▪ Vegetate road embankments and road cuttings with fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. ▪ Use stone pitching or riprap at appropriate places especially around overpasses, bridges, culverts.	Complaint regarding sediment loss or water turbidity. Bridge locations; Retaining walls; Number of any non-compliance reports	Compliance with national and international guideline limits for soil quality	The full length of the road alignment	Contractor	RHD / SC
C04$_{EMP}$	Soil Compaction	▪ Compaction of soil due to	▪ Construction vehicles, machinery, and	Number of any non-	Compliance with	Construction sites along	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
	and Contamination	movement of vehicles and equipment's ▪ Contamination of soil due to leakage/spillage of oil, bituminous and non-bituminous debris	equipment to be stationed in the designated ROW to avoid compaction. ▪ Haul roads to be designated along the fallow and consolidated soil areas to reduce compaction of arable land. ▪ Fuel storage and filling to be undertaken in areas with concrete surfacing, bunds and interceptor traps ▪ Oil interceptors to be provided at wash down and refuelling sites ▪ Oil and grease spill and oil-soaked materials shall be sold off to authorized recyclers.	compliance reports Maintenance of temporary passages;	National/International guideline limits for soil quality	the full length of the project		
$C05_{EMP}$	Topsoil	▪ Removal of top soil for construction from outside the RoW. ▪ Compaction of topsoil. ▪ Loss of top soil by wind and water erosion. ▪ Covering of top soil by	▪ The stockpile top surface slope to be no steeper than 2 (H):1 (V) to reduce surface runoff and enhance percolation through the mass of stored soil. ▪ Locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion.	Number of non - compliances observed/ reported	Compliance with National/International guideline limits for soil quality	Various construction sites throughout the road alignment	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		project works. .	▪ Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. ▪ Use stripped topsoil only to cover all disturbed areas and along the proposed tree plantation sites. ▪ Rip ground surface prior to the spreading of topsoil, ▪ Limit equipment and vehicular movements to within the approved construction zone. ▪ Remove unwanted materials from topsoil such as roots of trees, rubble and waste etc.					
C06EMP	Air Quality	▪ Dust Generation due to construction activities and transport of construction materials. ▪ Emissions from vehicles, equipment	▪ Vehicles transporting construction material to be covered ; ▪ Construction equipment to be maintained to a good standard and idling of engines discouraged. ▪ Machinery emitting visible smoke to be banned from construction sites; ▪ Contractor to prepare a dust suppression	Location of stockpiles; Number of complaints from sensitive receptors; Heavy equipment and machinery with air pollution control devices;	Compliance with DoE and National guideline limits for Air at sensitive receptors. Certification that vehicles are compliant with air	Construction sites along the full length of the project	Contractor	RHD/SC/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		and machinery.	program detailing action to be taken to minimize dust generation (e.g. spraying of roads with water), and the equipment to be used. ▪ Equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce dust emissions; ▪ Locate asphalt and crushing plants away from residential areas and social infrastructure such as mosques, schools and madrasas. (Refer to Appendix E for locations of these). Clearance should be at least 500 m and take into account the prevailing wind direction ▪ Dust masks to be provided to workers where dust hazards exist. ▪ Proper dust collection and control systems to be installed at crushers	Ambient air quality found beyond the national standards; Levels of SOx, NOx, CO, PM_{10}, $PM_{2.5,}$	quality standards.			

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			▪ Air quality monitoring to be carried out as per the schedule in the environmental monitoring plan.					
C07$_{EMP}$	Noise and Vibration	▪ Noise from construction vehicles, equipment and machinery. ▪ Vibration caused by construction activities.	▪ Use of modern plant and equipment with appropriate muffling devices. ▪ All powered mechanical equipment and machinery to be fitted with noise abating gear such as mufflers for effective noise control, in compliance with DoE regulations. ▪ Construction operations to be restricted to 0700 to 1800 hours. ▪ Locate rock crushing, concrete mixing and material shipment yards away from residential areas, schools, colleges and hospitals. ▪ Install temporary noise barriers near sensitive locations such as schools, religious places and hospitals (Refer to Appendix E for locations)	Number of complaints from sensitive receptors; Noise measurement data Use of silencers in noise-producing equipment and sound barriers;	Equivalent day and night time noise levels Compliance with DoE and National guideline limits for Noise at sensitive receptors.	Construction sites along the full length of the project	Contractor	RHD/SC/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			▪ Providing the construction workers with suitable hearing protection like ear cap, or earmuffs etc. ▪ In areas, where structures may to be affected by vibrations from construction activities, take precautions to minimize the vibration and the resulting impact. ▪ Noise quality monitoring to be carried out as per the schedule in the environmental monitoring plan.					
$C08_{EMP}$	Topography and Landscape	▪ Land degradation due to careless excavation from borrow area	▪ Borrow pits to be opened within the road right of way and not on agricultural land ▪ Top soil to be preserved. Borrow pits to be rehabilitated. ▪ Borrow pits opened on private land, to be either closed or converted to ponds at the completion of work as per the written direction of the landowner.	Worksite clear of hazardous wastes such as oil/fuel Worksite clear of any wastes, collected materials from drainages, unutilized materials and debris Transport route and worksite	Compliance with National guideline for land use policy. Compliance with Waste management plan	Borrow areas	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			▪ Construction wastes to be used in construction activities.	cleared of any dust/mud				
C09$_{EMP}$	Construction Camps, Workshops and Processing Facilities	▪ Loss of plantation and vegetation. ▪ Permanent physical and visual impact on the area. ▪ Social disturbance for nearby community	▪ Construction camps and workshops to be located away from sensitive areas and not within 500 metres of existing settlements (Refer to Appendix E) unless agreed to after consultation with local people. ▪ Briefing and/or on-site training for the contractor's workers on the environmental requirement of the project and the implementation of mitigation measures. ▪ Minimise vegetation loss while making site arrangements for construction camps and other facilities; ▪ Crushing plants, sites for borrow pits, asphalt hot mix and batching plants to be located clear of environmentally sensitive areas, productive land or existing settlements	Worksite clear of hazardous wastes such as oil/fuel Worksite clear of any wastes, collected materials from drainages, unutilized materials and debris Transport route and worksite cleared of any dust/mud	Compliance with Waste management plan	Construction sites along the full length of the project	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			(Refer to Appendix E for locations); ▪ Construction material storage areas not to be located in sensitive areas and to be sheltered or sited within hoardings; ▪ Water and good sanitation facilities to be provided for the camps. ▪ Solid waste must not be dumped, buried or burned at or near the project site, but shall be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits. ▪ The sites for camps and associated facilities shall be rehabilitated after completion of the project.					
C10$_{EMP}$	Surface Water Bodies	▪Surface water body may affected	▪ No bituminous or hazardous materials to be used for filling of water bodies. ▪ Method statement on bridge/ culvert construction works should be prepared by the contractors will submit to the RHD for approval.	No visible degradation to nearby drainages, khals or water bodies due to construction activities	Effectiveness of water management measures	Refer to Appendix V.	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
C11$_{EMP}$	Surface Water Quality	▪ Contamination of surface water by disposal of construction waste. ▪ Pollution of domestic water supplies	▪ The workforce to be trained in proper means for storage and handling of materials and chemicals; ▪ Work camps and work sites to be provided with toilets and septic tanks; ▪ Proper drainage system with sedimentation ponds and oil separators to be provided to cope with the rain water and oil spills. ▪ Measures to be implemented to control oil spills near water channels ▪ Washing of machinery and vehicles in surface waters to be prohibited. Sealed washing areas shall be provided and wastewater shall be collected in a sedimentation/retention pond for treatment prior to release. ▪ Avoid or minimize damage to water channels; ▪ Conduct regular water quality monitoring	Areas for stockpiles, storage of fuels and lubricants and waste materials; Number of silt traps installed along trenches leading to water bodies Records of surface water quality inspection; Levels of pH, TOC, PO_4, TSS, DO, oil and grease	Compliance with National guideline limits for Surface water.	Construction sites along the full length of the project particularly beel / lowland / pond / ditch areas (Refer to Appendix E)	Contractor	RHD/SC/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			according to the determined sampling schedule; ▪ Prevent construction debris from entering drainage or irrigation canals; ▪ Construction work close to ponds or other water bodies to be minimised especially during monsoon season; ▪ Wastes to be collected, stored and taken to approve disposal sites.					
$C12_{EMP}$	Groundwater Quality	▪ Contamination of underground water table from leachate of construction waste.	▪ Arrangements for safe drinking water to be made prior to start of work. Water for consumption to be supplied only after adequate analysis and requisite treatment. ▪ Train workers on the need for judicious use of freshwater resources. ▪ Water reserves to be protected from contamination such as construction and oily waste.	Monitoring in accordance with monitoring program. No breaches of Material Safety Data Sheet (MSDS) for hazardous substances. ▪ Levels of pH, $CaCO_3$, Cl^-, Mn, As, Fe, total coliform, fecal coliform	Compliance with National guideline limits for Ground water.	Construction sites along the full length of the project	Contractor	RHD/SC/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
C13$_{EMP}$	Waste Pollution	▪ Unhygienic conditions, health risk to workforce and general public at the camp site.	▪ Solid and liquid wastes to be disposed at designated sites and no waste to be disposed in productive agricultural land; ▪ Hazardous waste to be transported to nearby incineration facility; ▪ Sanitary wastes generating from staff and labour camps to be disposed of in an environmentally friendly manner, i.e. provision of septic tank etc. for toilet wastes; ▪ Pavement materials from the existing road to be incorporated in the upgrading works. ▪ Develop a plan for waste management prior to commencing of construction and get approval from RHD.	Air (PM_{10}) and noise level measurements ; Dust pollution; Number of non-compliances observed/ reported	Compliance with Waste management plan	Construction sites along the full length of the project (Appendix V)	Contractor	RHD/SC/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		in dredged material	▪ While dredging, special care to be given to prevent any spillage/seepage of oil from the dredging machines; ▪ If owners of the ponds and lands near the road alignment want to use their area for fisheries project, the contractor may collect filling materials from that area through proper contract and dredging guidelines. ▪ Dredged material from the river bank to be tested for presence of heavy metals and other pollutants before its use. Note – some areas were tested during the preparation of IEE (refer to Table 4.2).					
$C14_{EMP}$	Flora	▪ Loss of habitat due to tree cutting ▪ Vegetation loss due to site preparation and	▪ Trees suited to the tract to be planted (see Appendix G for tree plantation plan); ▪ Flowering and fruiting shrubs to be planted along the RoWs to beautify the landscape;	Number of complaints from sensitive receptors on disturbance of vegetation. Illegal felling of trees PMO and PIU to report in	Compliance with Tree management plan	Construction sites along the full length of the project	Contractor	RHD/SC/FD

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		construction activities	▪ Contractor's personnel to be directed not to damage any vegetation such as trees or bushes. ▪ Construction vehicles, equipment and machinery to be limited to their designated areas of movement. ▪ Gas cylinders to be used for fuel at the camps for cooking purposes. Cutting of trees/bushes for fuel not to be allowed. ▪ Camp sites and asphalt plants to be established on waste/barren land rather than on forested or agriculturally productive land. However if such type of land is not available, it must be ensured that vegetation clearing is minimised and minimum damage is caused to the trees, undergrowth and crops.	writing the number of trees cut and planted if tree-cutting will be required (to be determined during detailed design stage)				
$C16_{EMP}$	Wildlife	Hunting of wildlife and	▪ Wildlife Department to check and confirm that no hunting occurs;	Number of complaints from sensitive	Compliance with National/Intern	Along the road alignment	Contractor	RHD/SC/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		birds during construction.	▪ New and good condition machinery with low noise generation characteristics to be used in construction; ▪ Construction work not to be carried out at night. ▪ Borrow pits to be fenced to protect animals.	receptors on disturbance of poaching. Illegal hunting	ational guideline for wildlife			
$C17_{EMP}$	Fisheries	▪ Impact on fishing activity (production, spawning and breeding grounds) ▪ Disturbance to aquatic life including migration of fish due to bridge construction	▪ Construction not to be undertaken during high flood. ▪ Construction along the riverbanks must be avoided during the fish breeding season (July to September). ▪ Deep water channel to be maintained during bridge construction.	Number of complaints from sensitive receptors on disturbance of fishing; Any evidence of fish mortality.	Compliance with National/International guideline	Throughout the road alignment particularly in beel/lowland/ pond/ditch/river areas (Refer to Appendix E)	Contractor	RHD/SC
$C18_{EMP}$	Land use	▪ Land disputes, soil erosion, loss of potential cropland and vegetation, landscape	▪ Agricultural areas not to be used as borrow areas. ▪ Land acquisition for borrow areas to be minimized. River sand to be used for embankment. Preference shall be	Number of complaints from sensitive receptors; Records of sources of materials	Compliance with National/International guideline	Borrow areas, access roads, bypasses	DC, Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		degradation, and damage to road embankments. ▪ Land use change due to borrowing of earth. ▪ Land use change and loss of productive top soil.	given to borrow earth from right of way wherever feasible; ▪ Necessary permits to be obtained for any borrow pits from the competent authorities and all environmental considerations to be ensured; ▪ Topsoil from borrow areas to be preserved and borrow pits to be rehabilitated after completion of borrow operations ; ▪ Borrow pits to be sited on waste land and at least 500 m away from the road; ▪ Priority to be given to borrowing from humps (including from digging of wells) above the general ground level; ▪ Priority should be given to the borrowing by excavating/enlarging existing borrow areas;					
$C19_{EMP}$	Traffic	▪ Traffic jams causing inconvenience to the people	▪ Provision to be made for passing traffic during construction ▪ Traffic management shall be undertaken in coordination with the	Traffic route during construction works including number of	Compliance with Traffic management Plan	Construction sites along the full length of the project (Appendix W)	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			local traffic police department. Develop a site-specific ▪ TMP prepared by the contractor that should be approved by RHD before commencement of construction work.	permanent signage, barricades and flagmen on worksite; Number of complaints from sensitive receptors; Number of signages placed at project location; Number of walkways, signage, and metal sheets placed at project location				
$C20_{EMP}$	Cultural Sites	▪ Noise and dust pollution and movement of the people to the nearby schools, colleges, mosques, and graveyards etc.	▪ Timely completion of the construction work and provision for movement through or around the construction site; ▪ Workshops and storage / processing facilities and labour camp to be sited so as to maintain proper clearances from the cultural sites.	No complaints from sensitive receptors	Compliance with National guideline limits for Noise and dust.	Along the road alignment (Refer to Table 4.15 and Appendix E)	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
C21$_{EMP}$	Income and Employment	▪ Income loss due to the loss of agricultural lands, private structures and common property resources and rehabilitation of the households.	▪ Contractor as far as practicable to recruit construction workers from amongst the locals and to maintain gender equity while employing the locals. ▪ Priority shall always be given to people from amongst the project affected persons, the unemployed and lower income groups. ▪ Set aside-areas within the contractor's camps/labour shed for local people to sell their products and to provide additional services to the workers.	Employment records.	Compliance to Bangladesh Labor Law of 2006 and other applicable standards	Along the road alignment	Contractor	RHD/SC
C22$_{EMP}$	OHS - Workers	▪ Health risks due to unsafe working conditions	▪ Worker's compensation insurance to be taken out for all project staff; ▪ Basic medical training to be given to specified work staff ▪ Basic medical service and supplies to made available for workers; ▪ Appropriate personal protective equipment (hearing protection, safety glasses, helmets, protective	Equipped first-aid stations Medical insurance coverage for workers Number of accidents Records of supply of uncontaminated water Condition of eating areas of workers	Compliance to emergency response plan	Construction sites along the full length of the project (Appendix X)	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			footwear and gloves, high visibility vests and other protective clothing) to be provided to all workers; ▪ Provision of adequate sanitation, washing, cooking and dormitory facilities including lighting; ▪ Adequate signage, lighting, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads. ▪ Application of preventive and protective measures consistent with international good practices such as the World Bank Group's Environment, Health and Safety Guidelines. ▪ Prepare an OHS plan, including hazard analysis (including COVID-19 hazards as well as the usual construction and transportation hazards), training of all	Use of personal protective equipment % of moving equipment outfitted with audible back-up alarms Permanent sign boards for hazardous areas Signage for storage and disposal areas Condition of sanitation facilities for workers. Record of H&S orientation trainings				

C23$_{EMP}$	OHS - Community	▪ Safety risks due to construction works	▪ The labour works with different transmittable diseases should be restricted within the construction site. ▪ Drivers operating construction vehicles to be trained in road safety awareness; ▪ Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links; ▪ Provision of proper safety and diversion signage, ▪ Crossing provision to be made for pedestrians and vehicles near settlements ▪ Use of water not to disturb water availability for the public.	Number of accidents; Number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan; Number of complaints from sensitive receptors; Number of walkways, signage, and metal sheets placed at project location Permanent sign boards for hazardous areas Agreement between landowner and contractors in case of using private lands as work camps, storage areas, etc.	Compliance to emergency response plan	Construction sites along the full length of the project	Contractor	RHD/SC

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
C24$_{EMP}$	Asphalt Hot Mix Plant and Batching Plant	Major pollution sources	• Cleaning regularly the Batching Plant • Appoint 3rd party to coolect the resedure • Apply 3R policy • Montoring the mix palnt regularly • The furnace of the Asphalt Hot Mix Plant more then 100 feet so that the impact is less due to the hight.	Number of accidents; Number of permanent signage, Inspection Green tag	Compliance to emergency response plan	Construction yeard along the base camp of the project	Contractor	RHD/SC
C25$_{EMP}$	Site Reinstatement	Damage due to debris, spoils, excess construction materials. Potential impacts are negative and long-term but reversible by mitigation measures.	• Remove all spoils wreckage, rubbish, or temporary structures; • All affected structures rehabilitated/compensated; • The area that previously housed the construction worker shed is to be checked for spills of substances such as oil, paint, etc. and	Number of complaints from sensitive receptors; Records of sources of materials	Compliance with National/International guideline and contract specification	Construction sites along the full length of the project	Contractor	RHD/SC
OPERATION STAGE								
O01$_{EMP}$	Soil	▪ Erosion due to damage of embankment and during transportatio	▪ Turfing of embankment shall be maintained. ▪ Surveillance to protect the embankment from	No complaints from sensitive receptors	Compliance with National/ International guideline limits for soil	Along the road alignment particularly at erosion prone area	RHD	RHD

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		n of sand by sand miners along river ▪ Soil contamination due to accidental spillage from vehicular movement.	unauthorized accesses. ▪ In case soil erosion takes place, proper remedial measures will be undertaken to stop future impacts of loss of soils and the associated impacts caused by soil erosion; ▪ Proper measures must be ensured to prevent any oil spillage and leakage from the locomotives. ▪ Efforts will be made to clean the spills of oil, toxic chemicals etc. as early as possible.					
$O02_{EMP}$	Noise and Vibration	The noise levels are anticipated to increase due to traffic related noise pollution; vibrations from engines and tires and mainly use of pressure horns.	▪ According to monitoring results, additional sound barriers in form of trees and hedges will be discussed with the affected people and planted if agreed; ▪ Signs for sensitive zones (health centres / educational institutions etc.) to disallow the use of pressure horns; ▪ Enforcement and penalties against traffic rules violators;	No complaints from sensitive receptors	Compliance with National guideline limits for Noise level.	Along the road alignment particularly in the major road intersections and densely settlement areas	RHD	RHD/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			▪ Monitoring to protect the trees.					
$O03_{EMP}$	Air Quality	Increased traffic levels and congestion will lead to air pollution levels.	▪ Ambient air quality monitoring should be carried out during operation phase; ▪ Roadside tree plantations as applicable and feasible under harsh climatic conditions; ▪ Regular road maintenance to ensure good surface condition; ▪ Regular vehicle check to control/ensure compliance with air quality standards; ▪ Enforcement and penalties against traffic rules violators.	No complaints from sensitive receptors; Levels of SOx, NOx, CO, $PM_{2.5}$, PM_{10}	Compliance with National guideline limits for Air quality.	Along the road alignment particularly in the major road intersections and densely settlement areas	RHD	RHD/DOE
$O04_{EMP}$	Water Quality	▪ Contamination of water bodies from runoff from the roads containing oils and grease; ▪ Groundwater may get polluted due to contaminated road runoff	▪ In order to discharge rapid removal of storm-water/road runoff, cross slopes and longitudinal drainage will be provided in the design; ▪ Proper drainage system with sedimentation ponds and oil separators will be provided to avoid contamination by run-off and oil spills;	▪ No visible degradation to nearby drainages, khals or water bodies due to construction activities; ▪ Levels of pH, TOC, PO_4, TSS, DO, oil and grease (surface water)	Compliance with National guideline limits for Surface and Ground water.	Throughout the road alignment particularly in khal/lowland/rivers/pond/ditch areas (Refer to Appendix E)	RHD	RHD/DOE

EMP Code	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
		on earthen shoulders and embankments planted with grasses.	▪ Retention basins with reedbeds provided in the design will improve the quality of polluted storm-water/road runoff; ▪ Prior to operation, an emergency response plan for spills of hazardous materials and oil will be prepared. ▪ Groundwater quality monitoring will be carried out as per schedule suggested in the Environmental Monitoring Plan.	▪ Levels of pH, $CaCO_3$, Cl^-, Mn, As, Fe, total coliform, fecal coliform (groundwater)				
$O05_{EMP}$	Land Use	Development of commercial establishments, educational institutes etc., which may affect the land value	▪ All the facilities with the exception of restaurants and petrol/gas filling stations likely to pop up in the future will be prohibited within the RoW. ▪ The permission will be sought from the concerned authority for the development of any establishment along the project; ▪ The bridge site may also be developed as tourist spot with further beautification;	Number of complaints from sensitive receptors	Compliance with National/International guideline	Along the road alignment particularly in the urban and densely settlement areas	RHD	RHD

EMP Code[20]	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
			▪ The designated RoW shall be maintained free of any encroachment.					
O06EMP	Wildlife	Killing of animals in road accidents	▪ Raising of dense plantation of shady trees on both sides of the RoW shall provide resting, nestling and roosting habitat to the fauna and especially to the avifauna which is a major positive impact; ▪ Low width under passes with the provision of small net on the both side of the road shall be made where the animal movement is frequent.	Number of complaints from sensitive receptors on disturbance of poaching. Illegal hunting	Compliance with National/International guideline for wildlife	Along the road alignment	RHD	RHD/DOE
O07EMP	Fisheries	The damage of 44 ponds, 189 ditches and disturbance to fisheries species during construction of bridge and culvert over rivers and canals to build the road embankment.	▪ Provide logistic support to the PAPs of the water bodies to culture fish in other places in the PIA. ▪ Consult with the local fisheries department to enrich the fisheries resources; ▪ Efforts shall be made to maintain deep water stream for certain length on both end of the bridge.	Number of complaints from sensitive receptors on disturbance of fishing; Any evidence of fish mortality.	Compliance with National/International guideline	Throughout the road alignment particularly in khal/lowland and/rivers/pond/ditch areas	RHD	RHD/DOE

EMP Code[20]	Environmental Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Approximate Location	Institutional Responsibility	
							Implementation	Monitoring/ Supervision
O08EMP	Cultural Sites	Noise, vibration and whistling near to cultural sites like school, college, madrasa, health complex, temple, etc.	▪ Proper rehabilitation of the affected people and the religious and cultural monuments and structures; ▪ Noise problem can be mitigated through plantation of trees along the boundary of the cultural sites; ▪ Avoid unnecessary whistling at sensitive cultural sites.	No complaints from sensitive receptors	Compliance with National guideline limits for Noise and dust.	Along the road alignment	RHD	RHD
O09EMP	Road Safety	Increase in the number of road accidents and animals kills	▪ Speed limits shall be imposed. ▪ Safety signal shall be displayed along the road and speed limits be displayed as well as monitored especially along settlements; ▪ Traffic signs shall be provided to warn road users about speed limits, rest areas, eating establishments etc. ▪ Lanes, median, and sharp bends shall be reflectorized to improve road visibility at night time. ▪ Foot over bridge shall be provided near schools, markets,	Number of accidents; Number of complaints from sensitive receptors; Number of speed limit violations Installation of road safety signages	Compliance with road safety regulations	Along the road alignment particularly at road intersections	RHD	RHD

EMP Code	Environmental Acti	Potential Impacts	Mitigation Measures	Monitoring Indicator		Performance Target	Approximate Location	Institutional Responsibility	
								Implementation	Monitoring/ Supervision
			habitat areas for safe crossing of the roads ▪ Proper lighting shall be provided along						

Note: Once construction completed, all unused materials/waste must be taken away. Site should be cleared. No additional payments get for the Contractoor for cleaning the unused materials/waste from the construction site. No payment should be made if the site is not cleared. The contractors will not get the clearance and the final payment if the Contractor not clear all unused materials/waste from the construction site.

Table 50: Environmental Management Plan for Road Research Training Center (RRTC)

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
PRE-CONSTRUCTION STAGE:				
Improper design	• Earthquake hazard should be considered in the structural design of the Road Research and Training Centre (RRTC).	Pre-construction/ design stage	DSC	RHD
Lack of environmental specifications	• Prepare relevant environmental sections in the tender documents for bidders • Prepare a bid evaluations section for environment, according to ADB bid evaluation format • Prepare environmental contract clauses for contractors (refer to IEE)	Pre-construction/ design stage	DSC	RHD
Removal of utilities such as electricity line, gas connection, telephone connection, water supply and sewerage pipelines	• Necessary planning and coordination with concerned authorities. • Prior to start construction, all utilities should be shifted with the consultation of relevant authorities. Proper health and safety measures for the workers should be taken during shifting of the utilities to avoid any accidents.	Pre-construction/ design stage	RHD	DWASA/BTCL/ TITAS
Tree cutting	• After completing the detail design a baseline survey will be carried out for identify the number of trees cut off. • RHD will replant trees as per the prescription of forest department (FD) e.g min. two tree seedlings to be planted during monsoon period of operation stage for each tree felled. • Cutting, carry out and selling these trees should be as per GOB procedure to avoid any accident.	Pre-construction/ Operation	RHD/DSC	FD
CONSTRUCTION STAGE:				
Drainage Congestion	• Temporary drainage congestion (TDC) in the foundation trench due to rainwater to be removed by pumping. Avoid monsoon period for foundation works. • TDC in construction yard and camp of the proposed RRTC area to be removed by temporary earth or RCC drains. • All rainwater, storm water waste water etc. should be drain out via sewerage pipelines of DWASA.	During Construction	Contractor	RHD/DCC
Air Pollution	• Fit construction vehicles with appropriate exhaust systems and emission control devices.	During Construction	Contractor	RHD/DSC/DOE

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	• Maintain construction vehicles and equipment in good working condition including regular servicing. • Operate the construction vehicles in a fuel efficient manner. • Cover hauls vehicles carrying dusty materials moving outside the construction site. • Impose speed limits (maximum 10 km/hr) on all vehicle movement at the worksite and through access roads to reduce dust emissions. • Water spray to the construction materials or cover (especially sand and boulders/brick chips) prior to loading and transport. • Focus special attention on containing the emissions from generators. • Equipment/vehicles causing excess pollution (e.g. visible smoke) should be banned from construction sites or fixed immediately prior to further usage. • Provide filtering systems, dust collectors or humidification or other techniques (as applicable) to the concrete mixing plant to control the particle emissions at all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations. • Water spray to the material stockpiles as and when required to minimize the potential environmental nuisance due to dust. • Increase the watering frequency during periods of high risk (e.g. high winds and dry periods). Stored materials such as boulders and sand should be covered and confined to avoid them being wind-drifted. • Erect dust barriers along the boundary of the complex area to reduce dust movement to the surrounding areas. • Reschedule earthwork activities when practical, if necessary to avoid during periods of high wind and if visible dust is blowing off- site. • Restore disturbed areas as soon as possible by vegetation/grass- turfing. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations.			
Noise Pollution	• Maintain all vehicles in order to keep them in good working order in accordance with manufacturers maintenance procedures. • Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. (20 km/hr during night time). • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site.	During Construction	Contractor	RHD/DSC/DOE

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	• Appropriately site all noise generating activities to avoid noise pollution to local residents. • Modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines, silencers). • Maintain all equipment in order to keep it in good working conditions in accordance with manufacturers" maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment. • Avoid the unnecessary use of alarms, horns and sirens. • Notify adjacent landholders prior any typical noise events outside of daylight hours. • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions. • Employ best available work practices on-site to minimize occupational noise levels. • Install temporary noise control barriers (wooden or jute or plastic screen), especially at university site. • Plan activities on site and deliveries to and from site to minimize impact. • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.			
Sewage Pollution/ Sanitation Hazard	• Provide hygienic sanitary facilities and sewerage system. The toilets and domestic wastewater will be collected through a common sewerage. Provide separate latrines and bathing places for males and females workers with total isolation by wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Ensure the sanitary facilities are kept clean and without any odor. • Educate the workers of using the facilities.	During Construction	Contractor	RHD/DSC
Solid Waste Pollution	• Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, so as to cause less offsite environmental impacts. The disposal site should be approved by RHD prior to usage and should be rehabilitated after usage to ensure the land is not exposed to soil erosion, wind and water stagnation.	During Construction	Contractor	RHD/DSC

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	• Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the wastes, wherever practical. • Prohibit burning of solid waste. • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite and worker camps. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal by Dhaka North City Corporation (DNCC). • Ensure proper collection and disposal of all wastes within the construction camps from where DNCC will take by their truck and dispose at their dumping area. • Insist on waste separation and store by source; organic wastes, inorganic wastes and recyclables in separate containers. • Clear wastes on daily basis to waste collectors. Establish waste collection, transportation and disposal at the dumping site in adequate sizes of concrete chambers/boxes. • Dispose organic wastes in a designated safe place and should be kept covered so that flies, mosquitoes, dogs, cats, rats, etc. are not attracted. Encourage composting of organic waste that can be used for tree planting purposes. • Locate the garbage pit/waste disposal site away from the residence so that peoples are not disturbed with the odor likely to be produced from anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children from entering and playing. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved waste disposal sites.			
Liquid waste	• Train the relevant construction personnel in handling of fuels and spill control procedures. • Refueling shall occur only within enclosed areas. • Provide PPE such as protective clothing, safety shoes, helmets, masks and hand gloves to the construction personnel, to handle construction materials.	During Construction	Contractor	RHD/DSC

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	• Make sure all containers and drums that are used for storage are in good condition and are labeled with expiry date. Any container, drum that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Put containers and drums in permanent storage areas on an impermeable floor and dumping at Matuail CWDS, Dhaka. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Ensure basic firefighting equipment is in place outside these storage areas in case of a fire.			
Landscape	• Parking of construction vehicles and stockpiling of construction materials should be done in systematic way to avoid any drainage blockages, to enhance the aesthetics of the site. • Duration of stockpiling should be minimized as much as possible.	During Construction	Contractor	RHD/DSC
Road/Traffics	• Prepare and submit a traffic management plan to the PIU for approval at least 30 days before commencing work on project component involving traffic diversion and management. • Include measures in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, access roads, necessary barricades, warning signs / lights, road signs, etc. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Bangladesh Road Traffic Regulations of BRTA. • Restrict truck deliveries to daytime working hours (as common practice in Dhaka) to avoid road accidents and to reduce inconveniences to the road users. • Restrict the transport of oversize loads. • Operate construction vehicles to non-peak periods (night) to minimize traffic disruptions. • Enforce on-site and access road speed limits.	During Construction	Contractor	RHD/DSC/BRTA
Occupational H&S	• Implement suitable safety standards for all workers and site visitors which shall not be less than those laid down on the international standards (e.g. International Labor Office guideline on „Safety and Health in Construction; World Bank Group's „Environmental Health and Safety Guidelines") and contractor's own national standards or statutory regulations, in addition to	During Construction	Contractor	RHD/DSC

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	complying with the national standards of the Government of Bangladesh (e.g. `The Bangladesh Labor Code, 2006").			
	• Provide the workers a safe and healthy work environment, taking into account inherent risks of this particular construction activity and specific classes of hazards in the work areas,			
	• Provide personal protection equipment (PPE) for workers, such as safety shoes, helmets, masks, gloves, protective clothing, goggles, safety belt for working at height and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones.			
	• Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job.			
	• Appoint an environment, health and safety manager to look after the health and safety of the workers.			
	• Not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the Bangladesh Labor Code, 2006			
	• Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work			
	• Document and report occupational accidents, diseases, and incidents and actions taken.			
	• Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable the causes of hazards in a manner consistent with good international industry practice.			
	• Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures.			
	• Provide HIV awareness program, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis.			
	• Provide awareness to the construction drivers to strictly follow the driving rules.			
	• Provide adequate lighting in the construction area and along the roads.			
	• Adequate ventilation in all facilities.			
	• Provide plastic net and others appropriate H&S measures surrounding the buildings to avoid accidents.			

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	• Safe and reliable water supply. Water supply from DWASA that meets the national standards. • Hygienic sanitary facilities and sewerage system. The toilets and domestic wastewater will be collected through a common sewerage. • Carry out regular mosquito repellant spraying during monsoon periods. • Recreational and social facilities. • Safe storage facilities for petroleum and other chemicals. • Solid waste collection and disposal system. • Provide ambulance facility for the laborers to be transported to nearest hospitals during an emergency. • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work. • Establish a code of conduct for the contractor staff. • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. • Provide appropriate security personnel (home guard/private security guards) and enclosures to prevent unauthorized entry into the camp area.			
Community H&S	• All construction activities except movement of trucks should be during day time (6:00 to 21:00) • Construction trucks should be moved during night time to avoid accident.	During Construction	Contractor	RHD/DSC
Emergency Response	• Mitigation measure details in Chapter VIII (Emergency Response Plan)	During construction	Contractor	RHD
OPERATION STAGE:				
Drainage Congestion	• Maintain drains regularly as and when required. • Solid wastes should not be dumped into the drain. • Blocked drains should be cleaned properly and debris disposed at approved sites on a regular basis.	During Operation	RRTC	RHD/DCC
Noise Pollution	• In the project area, noise generation will be occurred due to too much vehicles (about 500 nos.) movement within the RRTC location. Since the noise pollution already exceeds the standard, therefore strict measures for noise pollution control need to be undertaken during operation stage. • A densely tree replantation to protect the nearby university from noise pollution. • The BRTA rules and regulations must be followed to reduce noise pollution.	During Operation	RRTC	RHD/DOE

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	• Restriction should be imposed on the movement of the old vehicles and use of hydraulic horn in the project area. • Continuous monitoring should be carried out.			
Air Pollution	• Number of mitigation measures can be conceived such as to follow BRTA relevant rules and regulations; and ban of old vehicles, etc.	During Operation	RRTC	RHD/DOE
• Landscape	• Maintain the RRTC properly • Maintain replantation of trees • Restrict to rebuild shops at outside of the RRTC complex area.	During Operation	RRTC	RHD/FD
Solid Waste Generation and Disposal	• Setting up of separate waste collectors at different points. • Regular cleaning and replacing of waste collectors. • Waste disposal at a safe place. • DNCC to collect solid waste every day and dispose to the landfill site at Matuail CWDS, Dhaka • Encourage waste sorting by the facility users.	During Operation	RRTC	RHD/DCC
Sewerage waste	• Maintenance sewerage pipes etc. as and when required. • Regular monitoring of water quality.	During Operation	RRTC	RHD/DCC
Occupational H&S	• A proper Maintenance and Operation (O&M) Plan should be prepared during detailed design and act accordingly during operation stage of the RRTC. • Proper acoustic system in the walls of the buildings for minimizing of noise and thermal pollution. • Firefighting equipment should be installed in each floor of the buildings, lift, kitchen, generator room etc. Adequate power capacity of generator (capacity>50kwt), installing in covered room, should be provided • Fire Extinguisher should be installed in each floor, lift, generator room etc. of the buildings. • Adequate lighting facilities and proper ventilation facilities for fresh air should be provided in all the buildings. • Before leaving the office rooms, power must be switched off • H&S signboards should be installed at the appropriate locations of the buildings. • First aid facilities and an experienced H&S Manager should be available. • Training on H&S should be provided for all RHD staff. • In case of any accidents, the victim must be sent to nearest clinic/hospital for proper treatment.	During Operation	RRTC	RHD

Environmental Impact	Mitigation Measures	Timeframe	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
Community H&S	• Preparaton of traffic management plan • All road safety measures should be followed for the crossing point and meeting point of RRTC entrance road • Follow BRTA rules on traffics	During Operation	RRTC	RHD
Environmental Risks	• Important issues related with safety during operational phase is monitoring of emergencies and establishing procedures to carry out rescues during sudden disasters such as earthquake, very high flood, fires, and accidents. • Plinth level of the buildings should be above high flood level. • Emergency equipment will be stockpiled in RRTC and personnel will be trained to serve on rescue teams. • Use of latest protective mechanism is recommended to avoid fire and other environmental risks.	During Operation	RRTC	RHD/DCC

Note: Once construction completed, all unused materials/waste must be taken away. Site should be cleared. No additional payments get for the Contractoor for cleaning the unused materials/waste from the construction site. No payment should be made if the site is not cleared. The contractors not get the clearance and the final payment if the Contractor not clear all unused materials/waste from the construction site.

D. EMP Implementation Schedule

372. An implementation schedule has been sketched based on the environmental components that may be affected during the construction and operation of the project. Since project is likely to have impact on various components of environment, a comprehensive EMP implementation schedule covering terrestrial and aquatic ecology, soil erosion, drainage congestion, tree plantation, air quality, noise, and vibration are provided in Table 51. Monitoring Plan has been separately suggested for pre-construction, construction and operation phase in Table 52.

E. Environmental Monitoring Plan

1. General

373. Environmental monitoring is an essential tool for environmental management as it provides the basic information for rational management decisions. The purpose of the monitoring program is to ensure that the envisaged purposes of the project are achieved and result in desired benefits to the target population.To ensure the effective implementation of the mitigation measures, it is essential that an effective monitoring program be designed and carried out. Compliance monitoring will be conducted in accordance with the environmental mitigation measures and monitoring plan provided with this report.

2. Objectives

374. The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. The main objectives of the pre-construction, construction and operation phase monitoring plans will be to:

- Monitor the actual impact of the works on physical, biological and socioeconomic receptors within the project corridor for indicating the adequacy of the IEE;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the IEE;
- Ensure compliance with legal and community obligations including safety on construction sites;
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMP;
- Ensure the safe disposal of excess construction materials.
- Appraise the adequacy of the IEE with respect to the project's predicted long-term impacts on the corridor's physical, biological and socio-economic environment;Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
- Compile periodic accident data to support analyses that will help minimize future risks; and
- Monitor the survival rate of avenue plantations.

Table 51: EMP Implementation Schedule

Environmental Issue	EMP	Time Line: Pre-Const'n (6 months)	Time Line: Construction Phase (36 months)	Time Line: Operation Phase (36 months)
Technical Support	Updation of environmental guidelines and performance indicators			
Flora	Tree cutting along the RoW			
	Compensatory afforestation (Minimum 1:2)			
Drainage Congestion	Provision of adequate opening			
	Monitoring analysis of drainage congestion			
Erosion, Sedimentation and Soil	River bank protection measures			
	Soil conservation			
	Monitoring of soil erosion			
Land	Compensation against land acquisition			
	Landscaping on approach road and service areas			
Slope/ Embankment protection at approach Road	Turfing of embankment with grasses and herbs			
	Embankment protection of the approach road			
Water and Drinking Water Supply	Monitoring of Surface Water Quality			
	Monitoring of Ground Water Quality and Levels			
	Installation of oil and grease traps at construction sites			
	Construction of soak pits at construction and rehabilitation sites			
	Ensuring arsenic free drinking water for construction camps			
Air Quality and Dust Management	Monitoring of Ambient Air Quality			
	Water Spraying/ Watering			
Construction Safety	Provision of PPEs			
Health Issues	Health Check-up Camps			
	Monitoring of Noise and Vibration			

Environmental Issue	EMP	Time Line																													
		Pre-Const'n (6 months)		Construction Phase (36 months)												Operation Phase (36 months)															
Noise Quality and Barriers	Monitoring of Tree Felling and Plantation																														
	Maintenance of tree																														
	Provision of Noise Barriers																														
Establishments	Construction Stage																														
Training	Environmental training and Awareness																														
Management Information System																															

F. Components to be monitored

375. Monitoring has two components:

Compliance monitoring, which checks whether prescribed actions have been carried out, usually by visual observation and by the use of checklists.
Effects monitoring which records the beneficial and adverse consequences of activities on the biophysical and social environment. This is often by repeat measurements of a set of objectively verifiable indicators.

376. Monitoring for this project will concentrate on compliance monitoring to ensure that measures are being implemented on time and according to sound environmental principles.

1. Pre-Construction stage compliance monitoring

377. Compliance monitoring during the pre-construction stage has three components:

i. Checking that the project's design incorporates appropriate measures to avoid or minimize negative environmental impacts.
ii. Incorporation of appropriate protective clauses in the contract documents that are to be complied with by the contractors.
iii. Acquisition of land issue and damages to properties are dealt with as per the Land
iv. Acquisition and Resettlement Plan (LARP) and compensated accordingly.

378. The detailed program of monitoring of various components is given in Table 53.

2. Construction stage compliance monitoring

379. Compliance monitoring during the construction stage comprises:

i. EMP which addresses the environmental issues in details to provide environmental protection.
ii. Contractors' compliance to the environmental clauses in their day-to-day activities.
iii. Implementation of tree planting and site clearance activities after completion of work.

Table 52: Existing Environmental friendly construction working components

No	Previous	Changes	Impact
1.	Flexible Pavement	Concreate Pavement around 40%	More strength and sustainability more then flexible pavement
2.	Aggregate Type 2 (Brick)	Aggregate Type 1 (Stone)	More environmental friendly and less emission as well as improve the environment
3.	No use of Concreate Paver Machine	Use of Concreate Paver Machine	○ Smooth Surface ○ Less friction ○ Emission less than anticipated
4.	Previously Pavement Recycling was less	Pavement Recycling more (almost 100%)	○ Use in Layer / Granular pavement ○ Asphalt pavement

No	Previous	Changes	Impact
5.	Polymer Modified Bitumen not use before	Polymer Modified Bitumen (Proposed)	Less carbon emission
6.	Use Still pole in W-Beam / Guard Rail	Proposed use Concrete pole in W-Beam / Guard Rail	Increase safety for using the Road
7.	SPC	Steel post (proposed)	More safe and environment friendly
8.	Compaction was standred previously	Modified Compaction used	Increase more strength and sustainability
9.	In the median use guardrail	In the median plant the trees those are not not big but dense more	○ Aesthetic beauty ○ Anti glare scenario ○ Sustainble ○ Environmental friendly

380. The environmental impacts during construction are highly dependent on (i) the contractors' work practices, especially those related to the storage of construction materials and cleanliness of the work sites; (ii) cooperation by the local authorities with the contractor in terms of traffic management and use of public space and utilities; (iii) project management's strict enforcement of the correct construction practices and standards; and (iv) the incorporation of the mitigating measures identified in the IEE into bid documents and specifications.

381. Direct monitoring during the construction phase will involve the following activities:

- Review of Contractor's proposed designs and working methods including a review at project start-up to ensure that the designs and working methods proposed by the contractors have taken account of the environmental constraints specified in the tender documents (geotechnical, ecological, social, safety).
- Site- specific review of contractors' temporary facilities; involving the inspection of contractor's worksites and work camps to ensure that the contractor's arrangements regarding temporary facilities are satisfactory.
- Regular site inspection during the construction period, involving scheduled and unannounced inspections to ensure that the stipulated procedures as defined in the EMP are being followed by the contractor(s). This monitoring will require the completion of systematic observations of site activities using checklists to be developed by RHD or its supervising consultants.
- Inspection of the certification of site clearance and restoration, to ensure that actual restoration has taken place, e.g., the temporary sewage works have been adequately disposed of.

3. Operation stage monitoring

382. The contractor will compile and maintain the environmental data and records gathered during the construction phase for reference during the operation phase. The contractor will coordinate with government departments and agencies, RHD in particular, for monitoring with respect to air quality, water, noise and traffic.

- The contractor in collaboration with the concerned department will organize monitoring of air quality and effects of the exhausts along the road project. Sensitive parameters including NO2, SO2 and particulate matters will be monitored and necessary measures will be taken to keep them within the limits set by government.

- The noise levels will be monitored to see whether they are within the limits. When they are found to exceed these limits and disturb the nearby settlements, noise abatement measures, like plantation of trees and construction of sound barriers will be taken.
- Monitoring will be done to ensure that both surface and groundwater quality will up to the standards. Mitigation measures will be taken in the design of new facilities and also from the point sources related to new developments and industry. Pollution control equipment's including wastewater treatment plants will be recommended for the local industry and accordingly monitored.
- The contractor will monitor that flora and fauna of the area is not disturbed by the increase of population and other activities in the area of influence. Tree plantation will be done. Any activity of the nearby residents (such as disposal of waste, land use change, etc.), which affects the environment, will be brought to the knowledge of the competent authority for necessary action.

383. The above monitoring system will be fully controlled by the project proponent i.e. RHD. A monitoring schedule has been included as guideline for the stakeholders (Table 53).

G. Monitoring Program

384. Monitoring points have been selected based on the sensitivity of the location with respect to sensitive receptors.

385. The schedule has been developed based on the possible occurrence of adverse impacts and required mitigation actions. However, this schedule is subject to change depending on the analysis results obtained. The protocol for changing the monitoring schedule is given below.

1. Tree Plantation

386. The 75% survival rate of re-plantation shall be monitored on the first year of the operation phase. If the survival rate is found below 75%, survival rate monitoring shall be again taken up after 3 years. This cycle should continue until the 75% survival rate is achieved.The compensatory tree plantation plan attached in the Appedix P.

2. Terrestrial and Aquatic Fauna including Fisheries

387. The fish productivity monitoring are important and sensitive issues. In case, any significant decline in terms of fish productivity in the khals/canals or ponds is noticed, the monitoring frequency shall be increased until the effectiveness of mitigation measures are established.

3. Soil Erosion and Drainage Congestion

388. No significant soil erosion problem is anticipated due to the project either in the construction phase or in the operation phase. However, in the construction phase, some localized soil erosion may be noticed owing to construction activities. However, if soil erosion is noticed during construction and operation phase, the corrective action shall be initiated and frequency of check be increased to assess the tendency of occurrence.

4. Air and Noise Quality

389. Due to the variability of the construction activities, namely changes in batch composition, type of construction activity and other anthropogenic influences, the ambient air quality of the project area may change. If the air quality with respect to any parameter exceeds by more than 25% of its

last monitored value, the monitoring frequency shall be doubled and cause of the increase investigated. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

390. Similarly, due to the variability in traffic movement, namely changes in traffic volume, traffic compositions and other anthropogenic influences, the noise quality in the project area is likely to change. If the noise quality exceeds by 20% of the applicable ambient noise quality standard or 5% of its last monitored value, the monitoring frequency shall be increased and the cause of the increase investigated. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

5. Water Quality

391. No significant change in water quality is perceived due to the project in the operation phase. However, in the construction phase, the monitored values for pH, BOD, COD, TDS, DO and Oil and Grease might change owing to construction activities. Hence, it is suggested that if the monitored value for any water quality parameter exceeds by more than 20% of its last monitored status the monitoring frequency shall be increased. If the construction activities are found to be the reason for this increase, suitable measures should be adopted.

Table 53: Environmental Monitoring Plan

EMoP Code	Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
						Implementation	Supervisio
Pre-Construction Stage							
$P01_{EMoP}$	Dredged materials	Lead (Pb), Cadmium (Cd), Cromium (Cr), Copper (Cu), Zinc (Zn), Manganese (Mn), Arsenic (As), Selenium (Se), and Mercury (Hg)	Government of Bangladesh (GoB) and international standard	Proposed dredging sites	Once prior to start dredging	Contractor	RHD/Construc n Supervision Consultant (CSC)
$P02_{EMoP}$	Air Quality	$PM_{2.5}$, PM_{10}, CO, SO_2, NO, NO_2, O_3, VOC, Temperature, Humidity, Wind Speed and Wind Direction	Air quality standard by DOE, Bangladesh	Major road intersecti ons	Once	Contractor	RHD/CSC
$P03_{EMoP}$	Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Major Road Intersections and inhabited locations and sensitive areas	Once	Contractor	RHD/CSC
$P04_{EMoP}$	Water Quality	Surface water: pH, TOC, Total Phosphate, TSS, Oil and Grease, and DO	Surface water quality standard by DOE, Bangladesh	Surface water near project site	Once	Contractor	RHD/CSC
$P05_{EMoP}$		Groundwater: pH, Mn, As, Fe, Cl^-, Total hardness, TC, FC	Groundwater quality standard by DOE, Bangladesh	Groundwate r near project site	Once	Contractor	RHD/CSC
$P06_{EMoP}$	Wildlife	Wildlife habitat and movement	None Specific	Areas alongside the road	Once	Contractor	RHD/CSC
$P07_{EMoP}$	Tree felling	▪ Monitoring activities outlined in RP; ▪ Check whether proper compensation as mentioned in RP is	Inspection	ROW along the alignment	During tree felling and site clearing operations	Contractor/ NGOs/RH D	RHD/CSC

EMoP Code	Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
						Implementation	Supervision
		received by PAPs.					
Construction Stage							
$C01_{EMoP}$	Air Quality	$PM_{2.5}$, PM_{10}, CO, SO_2, NO, NO_2, O_3, VOC, Temperature, Humidity, Wind Speed and Wind Direction	Air quality standard by DOE, Bangladesh	Hot mix plant, concrete mixing plant/stone crushers at construction sites	Quarterly	Contractor	RHD\CSC
$C02_{EMoP}$	Dust	Dust control	Air quality standard by DOE, Bangladesh	Construction site and ROW along the alignment	Quarterly	Contractor	RHD\CSC
$C03_{EMoP}$	Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Construction sites and inhabited locations and sensitive areas	Quarterly	Contractor	RHD\CSC
$C04_{EMoP}$	Water Quality	Surface water: pH, TOC, Total Phosphate, TSS, Oil and Grease, and DO	Water quality standard by MoEF, Bangladesh	Surface water near project site	Quarterly	Contractor	RHD\CSC
$C05_{EMoP}$		Groundwater: pH, Mn, As, Fe, Cl^-, Total hardness, TC, FC	Water quality standard by MoEF, Bangladesh	Drinking water to made available to construction camps and ground water near project site	Quarterly	Contractor	RHD\CSC
$C06_{EMoP}$	Soil Erosion	Visual check for Soil erosion and siltation		All major water bodies	Once during rainy seasons of the construction period.	Contractor	RHD\CSC
$C07_{EMoP}$	Drainage congestion	▪ Check drainage plan implemented correctly ▪ Conduct regular inspection	Monitoring	Construction site	Weekly during monsoon	Contractor	RHD\CSC

EMoP Code	Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
						Implementation	Supervision
$C08_{EMoP}$	Soil Pollution	▪ Check liquid waste is carried out by experienced personnel and in proper way ▪ Careful and proper handling of oil and other hazardous liquids	Monitoring	Construction Yard, dumping site	Regularly	Contractor	RHD\CSC
$C09_{EMoP}$	Wildlife	Wildlife habitat and movement	None Specific	Areas alongside the road alignment	Quarterly	Contractor	RHD\CSC
$C10_{EMoP}$	Fisheries	Impact on fish productivity , breeding and spawning		All major water bodies	Once in a year	Contractor	RHD\CSC
$C11_{EMoP}$	Waste	▪ Check storage, transportation, disposal, handling of hazarders waste ▪ Waste and effluents to be collected and disposed safely from all camps. ▪ Wastes and garbage from bridges construction sites to be disposed safely	Monitoring	Construction Yard, dumping site	Weekly	Contractor	RHD\CSC

$C12_{EMoP}$	Health and Safety	▪ Check quality of food and accommodation at construction camp; ▪ Check safe water supply, hygienic toilet at camps, construction of drain at camp sites; ▪ Check toilets are close to construction site and separate toilet for female workers;	Monitoring	Construction site and labor camp	Regularly	Contractor	RHD\CSC

EMoP Code	Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
						Implementation	Supervision
		▪ First Aid Box with required tools and medicines; ▪ The heavy construction material to handled and stored safely putting due care on public safety; ▪ Heavy construction materials at bridges construction sites to be stored and handled safely; and ▪ Check of personal protective equipment (PPE) for worker at the sites					
$O13_{EMoP}$	Environmental Grievance	Environmental grievance box install the construction working area, so that common people express their complaints and suggestion	Monitoring	All major construction area	End of First year of Operation	RHD	RHD\CSC
Operation Stage							

$O01_{EMoP}$	Tree Plantation	Check that the planted trees are maintained as mentioned in tree plantation plan	Inspection to ensure proper plantation with proper species	Along the road	Regular during June/July	RHD	RHD\DOE
$O02_{EMoP}$	Air Quality	$PM_{2.5}$, PM_{10}, CO, SO_2, NO, NO_2, O_3, VOC, Temperature, Humidity, Wind Speed and Wind Direction	Air quality standard by DOE, Bangladesh	Major Road Intersections	1site/year for 3 years	RHD	RHD\DOE
$O03_{EMoP}$	Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Major Road Intersections and inhabited locations and sensitive areas	1site/year for 3 years	RHD	RHD\DOE
$O04_{EMoP}$	Water Quality	Surface water: pH, TOC, Total Phosphate, TSS, Oil and Grease, and DO	Water quality standard by DOE, Bangladesh	Surface water near project site	1site/year for 3 years	RHD	RHD\DOE

EMoP Code	Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
						Implementation	Supervision
$O05_{EMoP}$		Groundwater: pH, Mn, As, Fe, Cl^-, Total hardness, TC, FC		Groundwater near project site	1site/year for 3 years	RHD	RHD\DOE
$O06_{EMoP}$	Accident and Public Safety	Record of accidents, different level of disabilities/ fatalities.	None Specific	Thought out the project section	----------	RHD	RHD
$O07_{EMoP}$	Soil Erosion	Visual check for soil erosion and siltation		All major water bodies	After first precipitation	RHD	RHD
$O08_{EMoP}$	Soil Quality	Heavy metals		At each construction camp post restoration of construction camp site	Once at each construction site	RHD	RHD\DOE
$O09_{EMoP}$	Wildlife	Wildlife habitat and movement	None Specific	Areas alongside the road alignment	Quarterly	RHD	RHD\DOE
$O10_{EMoP}$	Fisheries	Impact on fish productivity , breeding and spawning		All major water bodies	End of First year of Operation	RHD	RHD\DOE

Table 54: Environmental Monitoring Plan (RRTC)

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
Pre-Construction Stage						
Air Quality	Test parameters: H2S, SOx, NOx, CO, CO2, TVOC, SPM, PM10	Air quality standard by DOE, Bangladesh	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
Noise Level	Test parameters: dB(A)	Noise Pollution Control Rules (2006)	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
Water Quality	Test parameters: Surface water pH, TDS, EC, TSS, Fe, NH3 – N, Cl2, DO, COD, BOD5	Surface water quality standard by DOE, Bangladesh	Surface water near Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
	Test parameters: Groundwater: pH, Mn, As, Fe, Cl-, Total hardness, TC, FC	Groundwater quality standard by DOE, Bangladesh	Groundwater near Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
Wildlife	Wildlife habitat and movement	None Specific	Areas along side the Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	Contractor	RHD/PIC
Tree felling	After completing the detail design a baseline survey will be carried out for identify the number of trees cut off	Inspection	Alignment along the Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	During tree felling and site clearing operations	Contractor/ NGOs/RHD	RHD/PIC
Construction Stage						
Air Quality	Test parameters: H2S, SOx, NOx, CO, CO2, TVOC, SPM, PM10	Air quality standard by DOE, Bangladesh	Hot mix plant, concrete mixing plant/stone crushers at construction sites	Twice	Contractor	RHD/PIC
Dust	Dust control	Air quality	Construction site and	Regularly	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
		standard by DOE, Bangladesh	ROW along the Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur alignment			
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Construction sites and inhabited locations and sensitive areas	Twice	Contractor	RHD/PIC
Water Quality	Test parameters Surface water: pH, TDS, EC, TSS, Fe, NH_3 – N, Cl_2, DO, COD, BOD_5, Oil & Greases	Water quality Standard by MoEF, Bangladesh	Surface water near Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Twice	Contractor	RHD/PIC
	Test parameters: Groundwater: pH, Mn, As, Fe, Cl-, Total hardness, TC, FC	Water quality standard by MoEF, Bangladesh	Drinking water to made available to construction camps and ground water near Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Twice	Contractor	RHD/PIC
Soil Erosion	Visual check for Soil erosion and siltation	None Specific	All major water bodies	Once during rainy seasons of the construction period.	Contractor	RHD/PIC
Drainage congestion	• Check drainage plan implemented correctly • Conduct regular inspection	Monitoring	Construction site	Weekly during monsoon	Contractor	RHD/PIC
Soil Pollution	• Check liquid waste is carried out by experienced personnel and in proper way • Careful and proper	Monitoring	Construction Yard, dumping site	Regularly	Contractor	RHD/PIC

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
	handling of oil and other hazardous liquids					
Wildlife	Wildlife habitat and movement	None Specific	Areas alongside the alignment	Quarterly	Contractor	RHD/PIC
Fisheries	Impact on fish productivity, breeding and spawning	None Specific	All major water bodies	Once in a year	Contractor	RHD/PIC
Waste	• Check storage, transportation disposal, handling of hazarders waste • Waste and effluents to be collected and disposed safely from all camps. • Wastes and garbage site to be disposed safely	Monitoring	Construction Yard, dumping site	Weekly	Contractor	RHD/PIC
Health and Safety	• Check quality of food & accommodation at construction camp; • Check safe water supply, hygienic toilet at camps, construction of drain at camp sites; • Check toilets are close to construction site and separate toilet for female workers; • First Aid Box with required tools & medicines; • The heavy construction material to handled and stored safely putting due care on public safety; • Check of personal protective equipment (PPE) for worker at the sites	Monitoring	Construction site and labor camp	Regularly	Contractor	RHD/PIC
Operation Stage						

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period Frequency/Sampling, No/ year	Responsibilities	
					Implementation	Supervision
Tree Plantation	Check that the planted trees are maintained as mentioned in tree plantation plan	Inspection to ensure proper plantation with proper species	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Regular during June/July	RHD	RHD/DOE
Air Quality	Test parameters:, SOx, NOx, CO, CO_2, PM_{10}	Air quality standard by DOE, Bangladesh	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Once	RHD	RHD/DOE
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur and inhabited locations and sensitive areas	Once	RHD	RHD/DOE
Accident and Public Safety	Record of accidents, different level of disabilities/fatalities.	None Specific	Thought out the project section	----------	RHD	RHD
Soil Erosion	Visual check for soil erosion and siltation	None Specific	All major water bodies	After first precipitation	RHD	RHD
Wildlife	Wildlife habitat and movement	None Specific	Proposed Road Research and Training Centre (RRTC), Paikpara, Mirpur	Quarterly	RHD	RHD/DOE

H. Environmental Budget

392. The estimated budget for implementation of the mitigation and monitoring measures proposed in the EMP is presented in Table 55. The overall costs of the EMP will comprise:

- Environmental monitoring through sample collection and analysis;
- Any remedial measures necessary to reduce or avoid environmental damage;
- Designing and implementing all mitigating and enhancement measures;
- Supervision staff from RHD and consultants including direct costs and travel subsistence.

393. The total budget is estimated as US$ 1.312 million.

Table 55: Environmental Budget for Hatikamrul-Rangpur Road

Component	Items	Unit	Quantity	Rate (BDT)	Total Amount (BDT)	Amount (million BDT)
CONSTRUCTION STAGE						
Air Quality	Measuring air quality	No.	24	25,000	600,000	0.6
Noise	Measur,ing ambient noise level	No.	72	5,000	360,000	0.36
	Provision for additional tree plantation / Noise Barriers	No.	Covered in EngineeringCost			-
Flora/tree plantation	Clearing of roadside plantation	No.	Covered in EngineeringCost			-
	Compensatory afforestation (Minimum 1:2) (Plantation and maintenance for three years)	No.	215,000	375	8,06,25,000	80.625
Water Quality	Surface water quality measurement	No.	72	20,000	1,440,000	1.44
	Groundwater quality measurement	No.	72	10,000	720,000	0.72
	Installation of oil and grease traps at construction sites @ 1 per site and 1 site per construction package (6)	No.	25	5,000	125,000	0.125
	Construction of soak pits at construction sites @ 2 per construction camp and 1 camp per package	No.	20	2,500	50,000	0.05
Agriculture	Institutional support for enhancing agricultural productivity (Development of demonstration plots for change in cropping pattern for cash crop or high yield variety)	Plots	20	50,000	10,00,000	1.0
	Technical support to farmers	Lump sum			25,00,000	2.5
Fisheries	Conversion of derelict pond into culture ponds and other support (fisheries seed distribution, demonstration ponds, technical support)	Lump sum			25,00,000	2.5
Drainage Congestion	Provision of adequate opening	Covered in Engineering Cost				-
Erosion and Sedimentation	River bank protection measures	Covered in Engineering Cost				-

Component	Items	Unit	Quantity	Rate (BDT)	Total Amount (BDT)	Amount (million BDT)
Soil	Maintenance cost in soil conservation	Covered in Engineering Cost				-
Slope/ Embankment protection at approach Road	Turfing of embankment with grasses and herbs	Covered in Engineering Cost				-
Dust Management	Water sprayer/watering	Covered in Engineering Cost				-
	Tarpaulin/Covering loose sand	Lump sum			10,00,000	1.0
Waste disposal and management	Disposal and management of construction waste	Lump sum			1,00,00,000	10.0
Traffic management	Road signages and traffic directional signs	Covered in Engineering Cost				-
Construction Safety	Accident risks in construction activity	Covered in Engineering Cost				-
	General Safety (provision of PPE like ear muffs, gloves etc.)	Lump sum			10,00,000	1.0
	Safety Signage (Accident prevention)	Lump sum			30,00,000	3.0
Health	Health check-up camps for construction workers	Camps	Camps/ year		50,00,000	5.0
Environmental Monitoring in construction phase	Monitoring Tree Felling and Plantation	Lump sum			25,00,000	2.5
	Fisheries	Lump sum			10,00,000	1.0
OPERATION STAGE						
Air Quality	Monitoring air quality	No.	3 (1/year)	25,000	75,000	0.075
Noise	Monitoring ambient noise level	No.	6 (1/year)	5,000	30,000	0.03
Water	Monitoring surface water quality	No.	6 (1/year)	20,000	120,000	0.12
	Monitoring ground water quality and levels	No.	6 (1/year)	10,000	60,000	0.06
Fisheries	Maintenance of Derelict Ponds or rehabilitation of Borrow Areas	Lump Sum			25,00,000	2.5
Tree survival	Provision of additional tree plantation (Plantation and maintenance for two year)	No. of trees	21500	125	26,87,500	2.6875
Monitoring of performance indicators	Monitoring tree felling and plantation	Lump sum			10,00,000	1.0
	Fisheries	Lump sum			10,00,000	1.0
	Monitoring of waste disposal and management	Lump sum			10,00,000	1.0
ESTABLISHMENT AND TRAINING						
Establishment	Construction stage	Per month	36	5,000	180,000	0.18

Component	Items	Unit	Quantity	Rate (BDT)	Total Amount (BDT)	Amount (million BDT)
	Operation stage	Per month	60	Tk. 31,250 for first three years of operation and Tk. 18,750 after three years additional two years	50,000	0.05
Training	Environmental training and awareness	Lump sum	As per training details		37,50,000	3.75
Management Information System		Lump sum			10,00,000	1.0
SUB TOTAL (ESTABLISHMENT and TRAINING)					4,980,000	4.98
SUB TOTAL (Construction, Operation, establishment and training)					12,68,72,500	126.8725
CONTINGENCIES @ 10 % on total Environmental Costs					1,26,87,250	12.68725
GRAND TOTAL (in BDT)					13,95,59,750	139.55975
GRAND TOTAL IN MILLION US$ (@ 1 US $ = 106.39 BDT)					13,11,775.07	**1.311775**

394. The variation of SASEC 2 upgrade the road safety, more functional, increasing the economic mobility and connectivity. It is connecting the dots. One dots represent one local economy, branch of peoples of their prosperity and livelihood.

VIII. INSTITUTIONAL ARRANGEMENT, CAPACITY BUILDING AND GRIEVANCE REDRESS MECHANISM

A. Institutional Arrangement

395. The Environmental Management Plan (EMP) implementation requires an organization support structure in the form of organizational requirements, training needs and plan, and information management system. The following section captures these institutional arrangements for EMP implementation by concerned officials of RHD, their consultants and working contractors.

396. The organizational structure of RHD is given in Figure 7.1. However, an organizational structure shall be developed at the corporate, regional and site level to aid effective implementation of the EMP document. Various departments will be involved during implementation of the project as shown in Figure 7.2. Contractor is responsible for implementation of EMP during works and Construction Supervision Consultant (CSC) is primarily responsible for supervision of monitoring of the implementation of the EMP. RHD will be supported by a Management Consultant (MC) to advise and assist RHD in quality and capacity enhancement and independent quality monitoring. Contractor will be responsible for implementation of EMP during work activities stage. Relevant departments responsible for implementation and supervision of proposed mitigation and monitoring measures are given in the EMP.

397. CSC will be responsible to monitor all activities of all contractors procured under the project. As several contractors will be working simultaneously for timely and speedy implementation of the project, it is important that CSC has an environmental unit to effectively supervise and monitor the environmental activities being implemented in the field. The CSC is also responsible to update or make necessary changes to the EMP if required based on the revised designs and locations.

398. A combined grievance redress committee is proposed to address grievances in both social and environmental issues. In addition, there will be NGOs working for plantation program and environmental awareness.

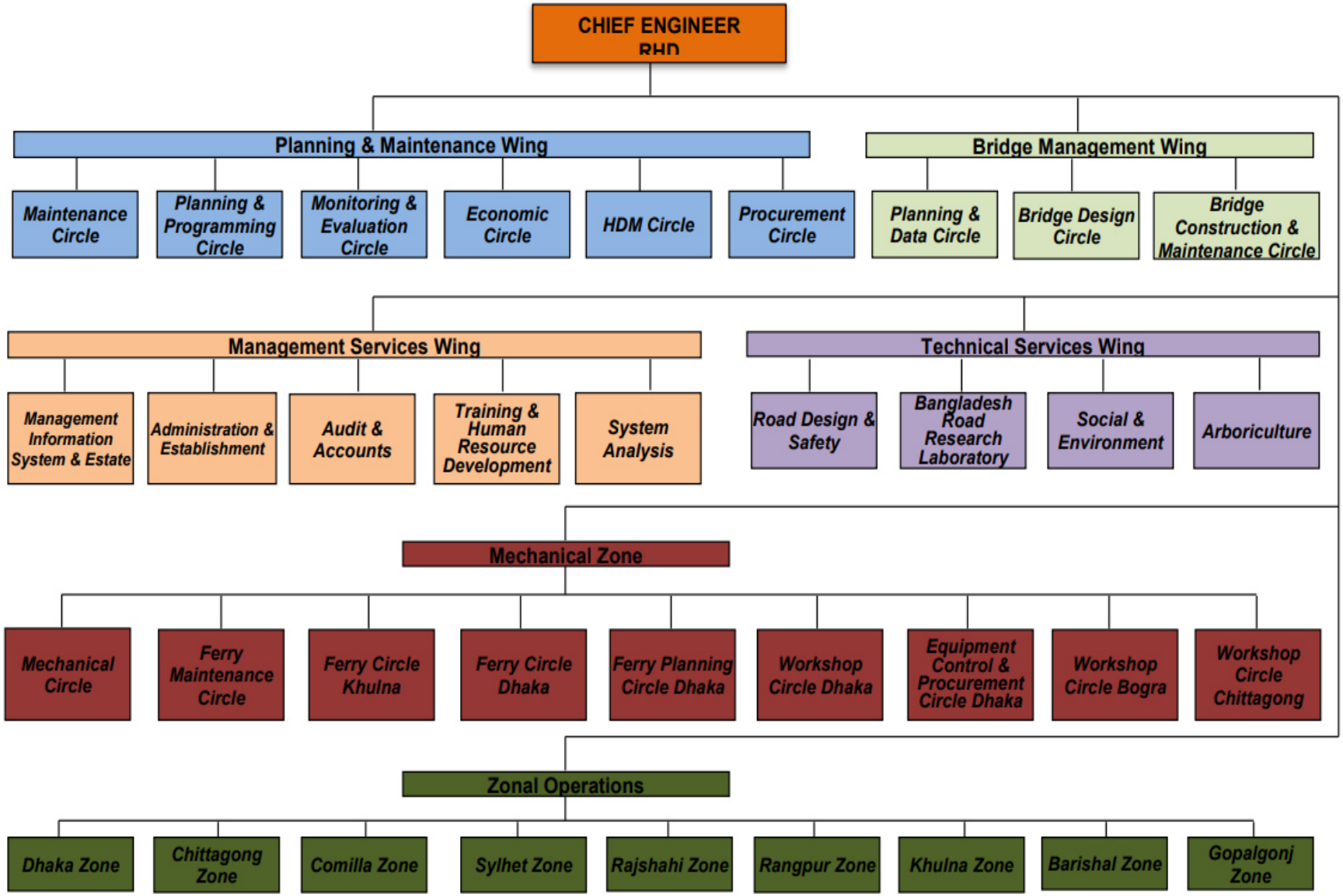

Figure 25: Organisation Structure of RHD

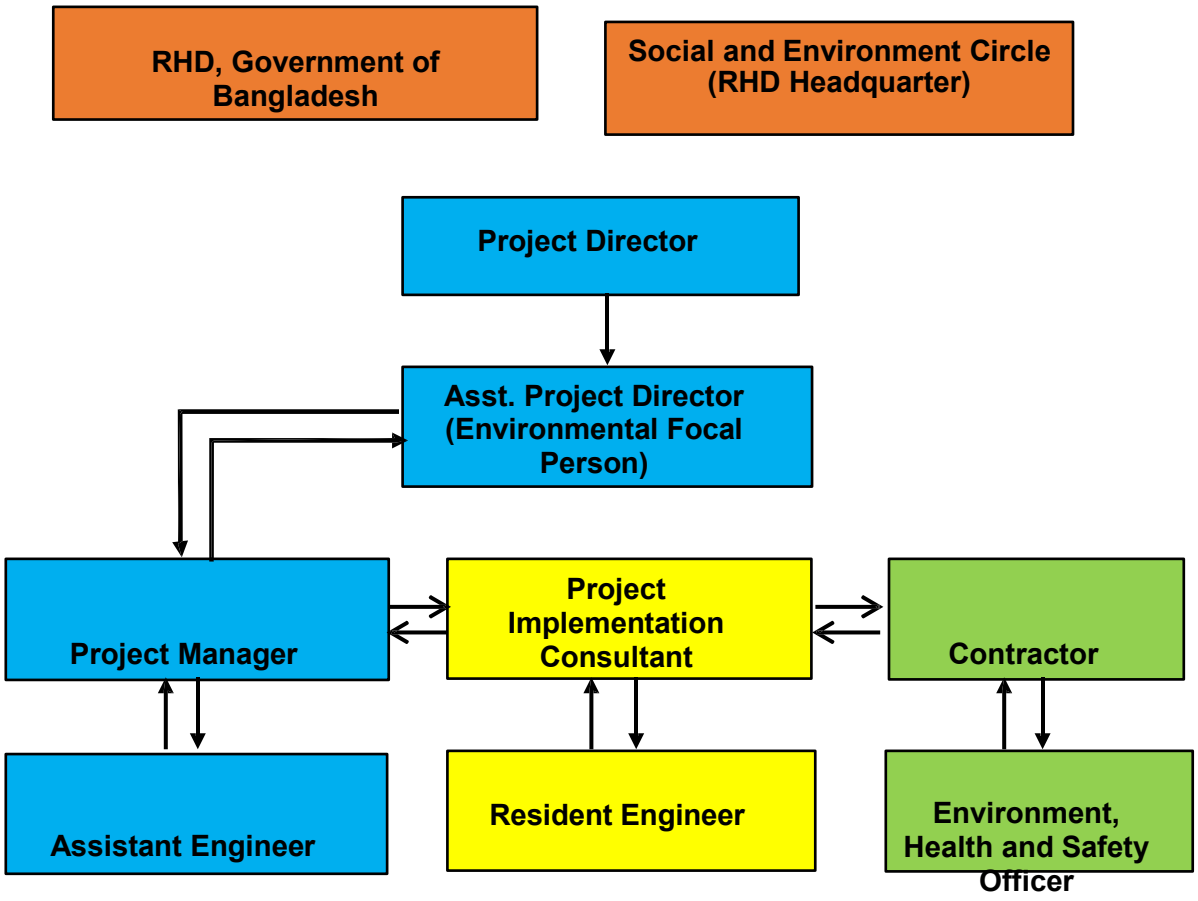

Figure 26: Proposed Organisation Structure of RHD for Hatikamrul-Rangpur Road Project[21]

[21] - Roads and Highways Department (RHD); - Project Implementation Unit; - Project Implementation Consultant; - Contractor

B. Institutional Roles and Responsibilities

399. The Roads and Highways Department (RHD) is the Executing Agency (EA) for the MFF and will be responsible for ensuring that all the components of the EARF are complied with. The RHD has the responsibility to ensure that the investment follows the legal requirements for environmental assessment. The RHD has an Environmental and Social Circle (ESC) headed by the Superintending Engineer who is supported by the Executive Engineer, Subdivision Engineer, Assistant Engineer and Sub-assistant Engineer.

400. Two Project Implementation Units (PIU) will be responsible for implementing phase 1 (Joydepur–Chandra–Tangail–Elenga)[21] and phase 2 (Elenga–Hatikamural–Rangpur)[22] of the MFF. Each PIU is headed by a Project Director (PD) who is supported by Additional Project Directors (APD). The PD for phase 1 is supported by 1 APD while the PD for phase 2 is supported by 3 APDs. At the site level there are 3 Project Managers (PMs) for the 4 contract packages under the phase 1 and 8 PMs for the 9 contract packages under the phase 2. Each PM is further supported by Deputy PM, Assistant Engineers and Sub Assistant Engineers.

401. The APDs serve as the environmental focal persons under each PIU. One of Assistant Engineers serve as the environmental focal person at the site level and support the respective APD on environment safeguard matters. Further the Project Implementation Consultant (PIC) responsible for supervising the civil works contractor will provide support to the respective PIU for day to day monitoring and reporting on environment safeguards.

402. The following elaborates the detailed responsibilities on environment safeguards:

1. RHD

403. As the EA for the investment program, RHD will be responsible for ensuring that all the environment safeguard requirements as provided in the Framework Financing Agreement (FFA), EARF and the respective IEE and EMP are complied with.

2. RHD (Environment and Social Cell)

404. The RHD Environment and Social Cell (ESC) is responsible for managing environment and social safeguards including safeguards related capacity building for all RHD projects. They will not be involved in the day-to-day implementation of safeguards for specific projects such as this investment program. The respective PIU will seek their support and advise on an as needed basis. Their overall responsibilities are:

- Ensure that all RHD works and projects are executed in accordance with appropriate environmental and social standards and practices.
- Liaise with GOB organisations and other line agencies to ensure effective inter-agency cooperation on relevant projects.
- Ensure the provision or procurement of the necessary services for carrying out
- Environmental Assessment, Land acquisition and Resettlement studies.

[21] Phase 1 is already under implementation under Loan 2949-BAN: South Asia Subregional Economic Cooperation Road Connectivity Project

[22] A new PIU for phase 2 has just been established

- Disseminate the need for high social and environmental standards throughout RHD and to the concerned public through research, publicity, seminars and training.
- Coordination the preparation and implementation of environmental and resettlement management plans for RHD projects as needed.
- Monitor long-term, cumulative environmental impacts and ensure mitigation measures for project sustainability.
- Conduct site inspections on selected RHD projects as needed
- Provide feedback on all environmental issues of existing and ongoing RHD projects and works.
- Review and preparation of Request for Proposal (RFP) and tender documents for procurement of Environmental Services (, IEE and EMP) for RHD projects.
- Assist the Director of RHD Training Centre in providing training to RHD officers in
- Environmental and Resettlement issues.
- Review and approve the Environmental Assessment reports and Environmental Monitoring reports produced by consultants/experts under RHD projects as needed.
- Establish and maintain environmental standards, guidelines and manuals in RHD.
- Identify environmental issues and constraints at project planning stage, suggest alternatives, options.
- Establish a reference library, containing relevant environmental documents (hard and soft copies) of domestic and overseas sources.
- Monitor long term environmental impacts on relevant RHD Projects
- Liaise with Road Safety Circle, Arboriculture Head and maintain intra-departmental co-ordination.

3. PIU (Environmental Focal Persons at Project Head Quarter and Site level)

405. The Additional Project Directors under the respective PIU will serve as the Environmental Focal Person at the Project Head Quarter level. At the site level an Assistant Engineer supporting the Project Manager will serve as the environmental focal person. The PIU will be responsible for ensuring proper implementation of environment safeguards in their respective projects including implementation of the EMP and EMoP, timely reporting and timely resolution of complaints and grievances. Their detailed responsibilities are:

- Prepare or engage consultants to prepare environmental assessment reports (, IEE, EMP) for project components as necessary
- Review and comment on the environmental assessment reports and environmental monitoring reports prepared by consultants and ensure they are
- prepared in accordance with requirements of RHD, DOE and ADB
- Ensure that the consultants while carrying out work at site follow the environmental standards, guidelines and manual of RHD.
- Take necessary steps to ensure timely receipt of DoE Environmental Clearance
- Ensure that the EMP and relevant environmental clauses are included in the contractors bidding documents
- Conduct spot checks on-site to monitor contractor's compliance with the EMP
- Review and endorse quarterly monitoring reports prepared by the PIC
- Review and endorse annual environmental monitoring reports prepared by the PIC
- for further submission to ADB for disclosure on the ADB website
- If there are any non-compliance issues or unanticipated environmental impacts ensure that necessary corrective actions are taken and IEE and/or EMP is updated as necessary

- Ensure that all grievances and complaints received are addressed in a timely manner and properly documented
- Carry out all other activities on environment safeguards on behalf of the PIU as needed.

4. Project Implementation Consultant (Environment Safeguards Team)

406. The proposed framework for implementation of the project shall utilize consultancy services from both international and national companies for the overall management and supervision of construction work on behalf of the EA. In addition to supervising the construction work of the contractor their role will be to check on conformity with the relevant clauses in construction contracts and national legislation and regulations. The following are the detailed responsibilities of the PIC.

- Review the IEE and EMPs of respective subprojects to understand the context and environmental issues of the project
- Establish monitoring and reporting protocols within the environment safeguards team at the site level and project headquarter level
- Require the civil works contractor to prepare sub-plans on environment safeguards such as camp layout plan, borrow area management plan, construction debris management plan, traffic management plan etc. as needed
- Review and approve all sub-plans on environment safeguards submitted by the civil works contractor
- Conduct regular (minimum of weekly) onsite inspections on implementation of the EMP by the contractor
- Ensure the contractor obtains all clearances, permits etc. related to environment safeguards on a timely basis
- Ensure the contract collects required environmental monitoring data (air, water, noise) as stipulated in the respective IEE report
- Provide on-site technical advice and training to the contractor as needed
- Organize training workshops on implementation of environment safeguards for the project team including PIU, RHD site offices, members of the PIC and civil works contractor
- Facilitate proper functioning of the grievance redress mechanism and maintain records of all complaints received and actions taken for inclusion in the environmental monitoring reports
- If there are any non-compliance issues or unanticipated environmental impacts ensure that necessary corrective actions are taken and update the IEE and/or EMP as necessary
- Review and approve the monthly progress reports submitted by the contractor
- Based on monthly progress reports submitted by the contractor and site inspections prepare quarterly environmental monitoring reports for review and approval by the PIU
- Based on the quarterly monitoring reports prepare annual environmental monitoring reports for review and approval by the PIU and further submission to
- ADB for disclosure on the ADB website
- Provide necessary technical support to the PIU on implementation of environment safeguards

5. Contractor (Environment Safeguards Team)

407. The tender for the construction of the project would be national/international competitive bidding contractors. The Contractor is legally mandated to implement the EMP and EMoP and obtain all environment related permits and clearances required for construction. The detailed responsibilities of the contractor on environment safeguards are the following:

- Recruit and appoint environmental focal persons and/or environmental health and safety officers on the construction site
- The contractor shall comply with all statutes and regulations concerning the execution of works as mentioned in DoE and RHD environmental guidelines.
- The contractor shall be responsible for familiarizing himself with all legislation elating to environmental protection that is relevant to his activities. Reference to rational environmental quality guidelines should be made.
- Implement the EMP approved by the PIC
- Prepare all sub-plans related environment safeguards such as camp layout plan, borrow area management plan, construction debris management plan, traffic management plan etc. as needed and submit for approval by the PIC
- Obtain all statutory clearances and permits on environment safeguards in a timely manner
- Conduct environmental quality monitoring (air, noise, water) as stipulated in the
- Environmental Monitoring Plan of the respective IEE report
- Take necessary measures to immediately address any complaints or grievances raised by local community or other stakeholders
- Prepare monthly progress reports on implementation of the EMP for approval by the PIC
- The contractor shall be responsible for the costs of cleaning up any environmental pollution resulting from his activities if methods for doing so are available and effective.

6. ADB

408. As a funding agency ADB is responsible for monitoring implementation of environment safeguards, providing technical guidance to the EA as necessary. Specific responsibilities entail the following:

- Review IEE reports including EMP provide feedback and disclose the reports on the ADB website as required by the ADB SPS;
- Provide assistance to RHD, if required, in carrying out its responsibilities and for building capacity for safeguard compliance;
- Monitor overall compliance of the MFF tranches and components to respective IEE and EMP through review missions;
- Review all environmental monitoring reports submitted by RHD, provide feedback and disclose the reports on the ADB website as required by the ADB SPS
- Provide guidance to the RHD and the PIU on issues related to inclusion of new component components, changes in component design, occurrence of Unanticipated environmental impacts during component implementation, emergencies and others as necessary.

C. Capacity Building

409. In Bangladesh, the environmental assessment process is established, but environmental awareness and capability for implementation of EMP in infrastructure projects are still developing. The project implementation unit (PIU) of RHD had some officers in the environmental and social circle department (ESC) that are delegated environmental duties. The delegated officers have

responsibility to bring environmental issues to the notice of senior management. Typically, the delegated officers have been moved to different departments due to promotions and operational needs after about every 3 years, and they move on to other engineering departments in RHD. The status quo is that ESC engineering officers are delegated to check environmental assessments prepared by consultants. The IEE and EMP are referred to the DOE in the Ministry of Environment and Forests (MOEF) for approval. The ESC in RHD is not directly involved with project implementation, but has more administrative responsibility to ensure environmental compliance and a general role to increase environmental awareness for RHD. It is therefore not clear if RHD/ESC has the capacity to check the adequacy of the developed EMP for this project.

410. The most significant challenge for environmental management on this project is the lack of human and financial resources and necessary infrastructure in PIU. To enhance the capacity of the RHD Environmental and Social Circle and PIU for effective implementation of proposed mitigation measures and monitoring the resultant effect, some training programs and awareness workshop are proposed. The detailed training plan is provided at Table 56.

Table 56: Training Plan

Target Group	Subject(s)	Method	Time Frame
Construction Stage			
Environmental engineers, field officers, contractors, supervision consultants	**Monitoring Environmental Performance during Construction:** Monitoring, Air, Water, Soil Erosion, Noise, and effect on wild life and fisheries, Evaluation and Review of results, Performance indicators and their applicability, possible corrective actions, reporting requirements and mechanisms	Lectures, Workshop and site visits	During construction phase
Contractor's staff, construction labourers	**Occupational Safety and Health:** Monitoring consultants/ organizations specializing in occupational, health and safety issues can provide training on this issue	Workshops and seminars	During construction phase
Construction labourers	Waste handling and sanitation at construction sites/construction camps	Workshops and signage	During construction phase
Environmental engineers, field officers, contractors,	**Long-term Environmental Issues in Project Management:** Designing and implementing environmental surveys for ambient air, noise, biological and water quality , data storage, retrieval and analysis, contract	Workshops and seminars	During construction phase
During Operation Phase			
General public and bridge users	Wild life protection and environmental protection awareness programme	Signage, workshops,	Construction and operation stage

411. It would be essential to understand the legislative framework and enhance capacity of Environmental and Social Unit of RHD and Field Officer (Environment) for analysing the applicability of various environmental legislations and clearances, approvals and compliance monitoring requirements. An environmental legislation applicability matrix framework has already been given in Chapter 2 above for ready reference.

D. Grievance Redress Mechanism

412. To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a Grievance Redress Mechanism (GRM) is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns.

413. Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective actions proposed using understandable and transparent processes that are gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. The responsibility for addressing the grievances along with proper timelines will be clearly indicated. Records of grievances received, corrective actions taken and their outcomes will be properly maintained and form part of the environmental monitoring report for submission to ADB.

414. The Project Implementation Unit (PIU) of RHD shall make the public aware of the GRM with the support of PIC through methods such as public awareness campaigns. Grievances can be filed in writing or by phone with any member of the PIU or PIC. The following steps procedures follow under the GRM.

415. First tier of GRM: The Site Project Manager (PM) under the PIU shall be the designated officer for grievance redress at the first tier. Resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

- initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and
- closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed off.

416. The updated register of grievances and complaints will be available to the public at the PM office, construction site, and other key public offices along the project area. Should the grievance remain unresolved within 7 working days, it will be elevated to the second tier.

417. Second tier of GRM: The respective site level PM will activate the second tier of GRM by referring the unresolved issue (with written documentation). The GRC shall be established by the PIU before commencement of site works. The GRC will consist of the following persons: (i) project director; (ii) representative of city ward; (iii) representative of the affected persons; (iv) representative of the local deputy commissioner's office (land); and (v) representative of the Department of Environment (DOE) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concerns and issues. The process will

facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days.

418. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

419. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land acquisition, asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

420. The respective APD and PM will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

421. Third tier of GRM: In the event that a grievance cannot be resolved directly by the Project Implementation Unit (PIU) (first tier) or GRC (second tier), the affected person can seek alternative redress through the city ward committees or in appropriate courts. The PIU or GRC will be kept informed by the city mayor authority.

422. The monitoring reports of the EMP and the resettlement plan implementation shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending). For upaditing the IEE public consultation meeting and Focus Group Discussion (FGD) several time done in the various work packages betwween Hatikamrul - Ranpur Road. No remarkable new scope found in the FGD and consultation meeting (Appendix P)

IX. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Background

423. This section deals with the information disclosure to the public and consultation sessions held with the different stakeholder groups that are likely to be affected by the implementation of the proposed project. The consultation process was carried out as per the guidelines of ADB's SPS 2009 and DoE environmental guidelines.

424. This consultation process had the following objectives:

- Share information with stakeholders on proposed improvement works and expected impacts on the physical, biological and socio-economic environment of the project corridor;
- Understand stakeholders' concerns regarding various aspects of the project,
- including the existing condition of the road, upgrading requirements, and the likely impact of construction related activities and operation of the improved road;
- Provide an opportunity to the public to influence project design in a positive manner;
- Obtain local and traditional knowledge, before decision making;
- Increase public confidence about the proponent, reviewers and decision makers;Reduce conflict through the early identification of controversial issues, and work through them to find acceptable solutions;
- Create a sense of ownership of the proposal in the mind of the stakeholders; and Develop the proposal which is truly sustainable.

B. Identification of Stakeholder

425. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. During the field survey different stakeholders identified were the villagers, local residents, government officials, shop owners, public representative, NGO's and general public. All those stakeholders had different types of stakes according to their professions.

C. Information Disclosed

426. The discussions were primarily focused on receiving maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the project. The purpose of this stakeholder consultation is to identify the views of major institutional and project affected persons (PAPs) stakeholders to the project area being examined, and to identify issues of relevance to the study, as well as any impacts which the project may have on project planned by the stakeholders, and to assess any mitigation measures which may be undertaken to minimize any adverse impacts of the proposals under consideration. This project will indeed be helpful for socio-economic development for central region of the country by timely transporting of essential goods and products required for agricultural and industrial development. Subsequently, stakeholder consultation is one of the important parts of the IEE to address the environmental aspects as well as socio-economic issues from stakeholders' point of view.

427. Stakeholder consultations were held during the different site visits in January 2014 for the IEE report preparation. Public Consultations, Focus Group Discussions (FGDs), Government Officials, Non-government Organizations, Individual Local People have been conducted continuously during the IEE study in conformity with the ADB and DoE guidelines. Project staffs

were carried out a series of stakeholder consultations at different locations of the project and 2019 to 2022 again Public Consultations, Focus Group Discussions (FGDs), Government Officials, Non-government Organizations, Individual Local People have been conducted for updating the IEE, total 15655 person (Woman 7086) are attendant in the of stakeholder consultations meeting at different locations the list is attached in the appendix F.

428. Issues were discussed in depth with the government officials and while in case of the people those issues were touched upon which are relevant to them. To begin with, they were given a brief outline of the project's objectives, type and components of the project in a simplified manner and in their native language. A set of pre-determined common questions were provided to the stakeholders to seek their perception of the project. The discussions with the stakeholders were focused mainly on the following points:

- Whether the project will help in providing safety to the people, their property and environment of the area,
- Any significant negative impact of the project on the overall environment of the area,
- Possible effects of the project on fisheries, trees, other habitats, agriculture, wetlands, drinking water availability and local economy
- The consultation process was undertaken after studying the project design and identifying the possible impacts due to the project execution and commissioning.
- Impact on the flora and fauna was mainly discussed with the officers of the forest department. The effect of air and noise pollution due to the project (during the design and construction stage) and effect on river water quality were focus of discussion with Department of Environment. Biological environment, disturbance on fishing activities and fish productivity, productivity of beels in the study areas of the projects and proposed mitigation measures were discussed at length with fisheries and wildlife Department.

429. Roads and Highways Department will continue to carry out consultations with affected people and communities in all phases of the project, to identify and help address safeguard issues that may arise.

D. Compliance with Relevant Regulatory Requirements

430. Public consultation was undertaken as per the ADB and DoE requirements. All the five principles of information dissemination, information solicitation, integration, coordination and engagement into dialogue were incorporated during the task. A framework of different environmental impacts likely from the project was strengthened and modified based on opinions of all those consulted, especially in the micro level by setting up dialogues with the village people from whom information on site facts and prevailing conditions were collected. The requirement of public consultation during the implementation of the project is proposed as part of the mitigation plan.

E. Major Comments Received

431. While a wide range of people from different administrative, social and economic backgrounds were consulted, their concerns and outcome of the consultation along with suggestions made by them are following section.

F. Government Officers' Comment

432. Stakeholders from different departments and institutes were consulted. Their concerns are summarized in the following Table 57.

Table 57: Details of Consultation with Government Authorities for Hatikamrul-Rangpur

Department	Name and Designation of the Government Official	Comments	Suggestions
Roads and Highways Department (RHD)	Rowshan Ara Khanam Superintending Engineer A. K. M. Mozammel Haque Executive Engineer	Priority Roads are priority. Department will be open to incorporate feasible environmental protection measures in road design.	Mitigative measures shall be simple and implementable. RHD is open for the implementable ideas for institutional capacity building
Department of Environment (DOE)	Md. Shahjahan Additional Director General Sayed Nazmul Ahsan Deputy Director (Environmental Clearance) Md. Monirul Islam Assistant Director Md. Samsuzzaman Sarker Assistant Director	Sourcing of borrow area earth is a concern in Bangladesh Needs adequate Baseline Environment Quality Determination for construction and borrow areas. Effective Measures must be developed for construction and operation stage both. Sourcing borrow earth from agriculture area is acceptable provided top soil is preserved.	Obtain prior environmental clearance being it a red category Project. Collect Soil from Multiple sources such as Char area or from riverbed, which will increase water depth in river and improve navigability of the river.
Department of Agriculture Extension (DAE)	Kalyan Kumar Sarker Upazilla Agriculture Officer Shajahanpur, Bogra Ummey Habiba Upazilla Agriculture Extension Officer Shajahanpur, Bogra Md. Shahidul Islam Upazilla Agriculture Extension Officer Royganj, Sirajganj Md. Sowkat Usman Upazilla Agriculture Officer Polashbari, Gaibandha Md. Khorshed Alam Upazilla Agriculture Officer Govindoganj, Gaibandha Dr. Md. Sorwarul Haque Upazilla Agriculture Officer Mithapukur, Rangpur	Agricultural land will be affected due to the project implementation Livelihoods of the families will be affected severely due to acquiring agricultural land. Noise pollution and Air pollution will be increased during bringing heavy machinery at the stage of construction.	Avoid agricultural land as much as possible. Tree plantation programme should be according to the government rule and must be in 1:2 ratio. Ensure the proper sprinkling of water during construction stage to control dust pollution.
Department of Fisheries (DoF)	Md. Ferdous Ali, Upazilla Fisheries Officer	Small water channels/ watercourses may be	Adopt measures to minimise dust, smoke,

Department	Name and Designation of the Government Official	Comments	Suggestions
	Md. Zillur Rahman Upazilla Fisheries Officer Sherpur, Bogra	abandoned due to non-availability of passages across the road.	and noise pollution, and to control spillages from construction machinery Drainage system will be provided to control surface runoff Do not wash the construction materials in ponds and ditches. Try to use a fixed place. Ensure the proper sprinkling of water during construction stage to control dust pollution.
	Md. Khalekuzzaman Sarker Upazilla Fisheries Officer Royganj, Sirajganj		
	Dr. Md. Aftab Hossain Senior Upazilla Fisheries Officer Polashbari, Gaibandha		
	Md. Harun-ar-Rashid Assistant Fisheries Officer Pirganj, Rangpur		
	Depok Kumar Paul Senior Fisheries Officer Mithapukur, Rangpur		
Local Government Engineering Department (LGED)	Md. Ahsan Kabir Upazilla Engineer Govindoganj, Gaibandha	This project will reduce some agricultural land because of land acquisition. Construction activities will cause noise and air pollution. Tree cutting will create imbalance to local environment.	Improve general standards of construction Plant trees along the highway that could reduce air and noise pollution. To prevent impacts due to noise all the noisy construction activities will be carried out in day time. Drainage system will be provided to control surface runoff.

Photograph 11: Consultation with Government Officials

433. Department of Environment, Ministry of Environment and Forests has highlighted that sourcing borrow earth is a concern in Bangladesh. Preference must be given to source borrow earth from char area or riverbed. They also highlight the need of establishing adequate Baseline Environment Quality conditions around borrow areas and road construction areas. They also emphasized that adequate mitigation measures must be planned incorporated in the road design. RHD must also obtain prior environmental clearance before start of construction.

434. Conservator of Forests, Wild Life and Nature conservation circle, advised to preserve the old tree. He indicated that Govt. plans to declare the old tree as heritage but the proposed tree conservation act yet not finalized. He also emphasizes that though there is no specific law governing number of tree to be planted against the number of tree cut but he highlighted that adequate number of tree shall be planted preferably on 1:2 ratios. He also highlighted on not to keep empty places during tree plantation. The evaluation and calculation of tree cutting and plantation should be done in association with forest department.

435. Officials from Bangladesh Forest Department also highlighted that the tree within ROW belongs to RHD even if these are old and RHD is free to cut these tree if so required. In reserved forests area no activity can be undertaken without permission.

436. Fisheries officers indicated that most of the ponds in this area are seasonal in nature and road development may not have direct impact on fisheries. However there are some reserved ponds, beels and rivers area for fish breeding and culture in the project location but those are far from the ROW. The project activity will not impact on the fisheries practices directly.

G. Focus Group Discussions

445. A focus group is a group of individuals selected and assembled by the environmental specialists to discuss and comment on, from personal experience. Central to successful group discussion was capturing a wide range of opinions about the impact and mitigation because of the road project. The groups consisted of more than five people and they were discussed for approximately half an hour to gather information and opinion they have. Altogether 13 FGDs were held starting from 18th January 2014 to 24th January 2014 and 21 to 22 March 2017. Approximately 174 participants, including several women, from different locations have taken part in those consolations. The schedules, venues and the participant's lists are given in Appendix L.

446. During the consultation, the participants spontaneously expressed their feelings about the importance of developing the road. They told that the project will remove current stress on road traffic and will ease their turmoil and reduce their commuting time. Moreover, business sectors will be greatly benefitted due to the improvement of communication system.

447. Most of the people told that the local air quality has been degraded from the emission of brickfields, industries and other man made sources. The participants expressed that the dredging materials should not be collected from the agricultural land since people are cultivating there. They told that there will be no major environmental impacts due to the project except a temporary impact of noise and dust from the engine of the construction transport and materials. Most of the people argued that they are willing to endure the temporary negative impact for the sake of the improvement of communication system which will improve their livelihood.

448. During the focus group discussion, people said that there will be no impacts on ground water and surface water. In accordance with people's information there are some wild life found in the area and rarely cross the road or die because of run over by the transport. People also told that there is no Environmental Protected Area in the project area. Finally, they answered that all of them are in favour of the project.

449. **Suggestions:** The following suggestions received from the consultation:

- The dredging materials should be properly managed as though local inhabitants face no troubles.
- Dredging materials should be deposited in a proper place that does not harm the local people and agricultural land.
- There should be effective mitigation measures in order to reduce noise pollution and emission from construction vehicles engine and materials.
- Initiatives need to be taken to stop surface water pollution.
- Water should be sprayed 2-3 times in a day to reduce the dust pollution.
- Tree should be planted in 1:2 ratio

Photograph 12: Photos of Focus Group Discussion at Various Locations

H. Local People's Comments

450. A number of informal public consultations were held along the priority roads. In all the places, respondents mostly welcomed the project. However, they did point out few issues of concern noise and air pollution, accident hazard along with loss of land and compensation issues. In the time of field survey 33 local people were interviewed (See Appendix M).

Table 58: Details of Consultation with Public in Hatikamrul-Rangpur Road Sections

Comments	Suggestions
• Good news • Very welcome step from Govt. • Improved road is essential and we welcome the road. • Commuting will be fast which will help improve business environment. • Difficult to cross the road due to heavy traffic, accident prone • Construction stage will create some inconvenience to people but that is tolerable. • Accident-prone area due high traffic and substantial movement of people in the business areas. • Increased traffic may cause air and noise pollution. • Local people will be benefited economically due to more employment opportunities.	• Road should be straight as it is sharply turning at this place or road ROW should be reduced. • Footpath and over-bridge should be constructed in appropriate and convenient (heavily used) locations so that common people may use it to avoid accident during road crossing. • Provide underpass at this location to facilitate easy movement of people who are moving in large number currently. • Require safe passage being a growth center. • Make appropriate measures in road design for safe passage. • Speed-breakers should be constructed near schools, hospitals and religious places. • Tree shall be planted wherever there is space available. • Tree should be planted in 1:2 ratios. • Water should be sprayed 2-3 times in a day to reduce the dust pollution.

451. A brief summary of comments of local people is presented in the following sections:

- Most of the people who were interviewed in the project area welcome the road expansion project as this is expected to improve the connectivity. Farmers have positively reacted to the development considering that better communication facility will fetch them better farm price. However, roadside shopkeepers and farmers have concern of loss of business due to widening of road and loss of livelihood.
- The people in the project areas were less concerned about the environmental problems, such as, air and noise pollution, top soil removal problem that may arise due to pre and post operation of road construction. However, they have raised concern regarding dust pollution and noise pollution near religious places and schools and suggested for adoption of appropriate mitigation measures for the control of it.
- The local people also mentioned that the environmental impact due to the proposed project is minor and short term. However, some mitigation measures should be taken during construction of the road, such as water spray to reduce dust pollution, tree plantation, and working hour should be only in day time and particularly if it will near the residential area.
- People have raised concern of accident during road crossing near village crossing due to increasing traffic. They have strongly demanded provision of foot over bridge and speed breaker. They also demanded for traffic management near big towns.
- Local people are of strong opinion for the early implementation of the project.

Photograph 13: Individual Interviews at Different Locations along the Road

I. Integration of Comments

452. As observed from their responses, almost everyone interviewed was supportive of the project and believes that it will help to provide the much-needed connectivity and development to the region.

453. During discussions, notes were taken for any issue raised and suggestions made. These were collated for a comprehensive analysis of the concerns raised. References have been taken from public opinion where no official data were available, while the officially available data have been extensively used for understanding of the study area characteristics. Each of the issues was then analysed on practical and scientific basis and accorded a likewise importance in terms of their magnitude in impacts and mitigation. For any significant concern, preventive or mitigation measures have been suggested drawing points from all the suggested measures.

J. Information Disclosure

454. Information is disclosed through public consultation and in making available relevant documents in public locations. The following documents will be submitted to ADB for disclosure on its website in accordance with the requirements of SPS 2009 and AIP 2019:

i. IEE (including project EMP);
ii. Updated IEE (including EMP) and corrective action plan prepared during project implementation, if any; and
iii. Environmental monitoring reports.

455. RHD will send a written endorsement to ADB for disclosing these documents on their website. The PIUs will provide the relevant safeguards information in a timely manner, in an accessible place and in a form and language understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used.

456. To meet disclosure requirements of ADB, a one-page project brief (both in Bangla and English) will be posted in the website of RHD and print-outs will be made available in the site offices of the PIU to interested individuals. The project brief will include the details of the GRM and the contact details of the designated focal person.

X. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

457. This Initial Environmental Examination (IEE) concludes that the environmental impacts will be manageable if the mitigation measures are implemented thoroughly. The EMP is based on the type, extent, and duration of the identified environmental impacts. The EMP has been prepared with close reference to best practices and in line with the ADB's Safeguards Policy Statement (SPS) and DoE environmental guidelines.

458. The project is classified 'B' in accordance with ADB's Safeguard Policy Statement 2009 requiring preparation of an Initial Environmental Examination Report. As per the Environmental Conservation Act, 1995 of Bangladesh, the project falls under Red category and requiring preparation of an IEE. This report is prepared keeping the ADB and GOB environmental requirements in consideration.

459. This IEE study was carried out when the Hatikamrul-Rangpur Road Subproject was at the detailed design stage of ADB Loan 2688-BAN. Essentially primary data was used to assess the environmental impacts in a comprehensive manner. Site survey for environmental data collection, public consultation and specific studies (flora, fauna, land use, hydrology) were carried out in order to complete the initial environmental examination and recommend suitable mitigation measures.

460. The potential environmental impacts were assessed in a comprehensive manner. The IEE report assesses the potential environmental impacts associated with the Hatikamrul-Rangpur Road Subproject, and suitable mitigation measures have been recommended. In the event that any design details of the Hatikamrul-Rangpur Road Subproject are changed, the IEE and EMP shall be reviewed and revised accordingly and submitted to DOE and ADB for acceptance.

B. Environmental Gains Due to Proposed Work Justifying Implementation

461. The project entails various impacts on the project setting. There are many impacts bearing benefits to the area against the limited number and magnitude of negative impacts. These include the following: (i) the project will substantially improve the transport efficiency on the road linking the Bangabandhu Bridge to Dhaka and the southeast road corridor (to Chittagong). (ii) This will contribute in integrating the southwest region into the national economy. (iii) The project once implemented will improve the overall environmental conditions with better roads and environmental protection measures (iv) will reduce traffic congestion at related air pollution due to idling of the vehicles due to widening as well as provision of flyovers and underpasses.

C. Potential Impacts, Mitigation, Management and Monitoring

462. The Hatikamrul-Rangpur Road Subproject offers a robust option for the enhancement of the existing road-based transportation network. Several actions are required during the detailed design stage to minimize impacts to acceptable levels. The negative environmental impacts from the Hatikamrul-Rangpur Road Subproject will mostly take place during the construction stage there are no significant cumulative adverse impacts during operation that are identifiable at this stage. The construction impacts should be very predictable and manageable, and with appropriate mitigation few residual impacts are likely. Additional human and financial resources will be required to improve environmental capability, and to progress and achieve necessary statutory compliance and environmental clearance certification for the Hatikamrul-Rangpur Road Subproject or associated activities that also require environmental assessment and environmental permits under the environmental laws of Bangladesh.

463. For updating IEE Air quality, ground water quality, surface water quality, noise level are tested again December 2022 and compared to the Base line data and existing data which has no remarkable changes at all. Few noise data are exceeded from the base line data. For this acceleration of data taking proper intervention to minimise the exceed level. Again Public Consultations, Focus Group Discussions (FGDs), Government Officials, Non-government Organizations, Individual Local People have been conducted to update the IEE.

464. The finding of IEE indicates that the project is unlikely to cause any significant adverse environmental impacts. The project proposed road expansion does not pass through or located nearby any national park, wildlife sanctuary, reserved forests, or any other ecologically sensitive or areas. No archaeological/protected monument is located in the project vicinity. The land use pattern around the alignment is predominantly agricultural.

465. While some of the impacts are negative, there are many bearing benefits to the area. Most of the impacts are likely to occur during construction stage and are temporary in nature. Some impacts require design consideration and are suitably addressed. The road alignment does not pass through or near to any ecologically sensitive/protected area. No archeologically protected monument either located in any of the project vicinity. The land use pattern around the road alignment primarily includes fallow land, agriculture land, rural settlement, and perennial or non- perennial water bodies. Urban settlement is also there but most of the populated locations either provision of flyover has been made or best engineering measures like RCC wall are taken to minimize the social impact. The impact is primarily caused due to land clearing for widening the carriageway, cutting of roadside full-grown trees, borrowing of earth, transportation of construction material, loss of water bodies/fish ponds, and construction of bridge.

466. The impacts are with regard to loss of terrestrial flora, impact on aquatic fauna, soil compaction, water contamination, and change in ambient air quality, water quality, and increase in ambient noise levels. During the operation, direct local impacts are mostly related to noise levels, air quality and road accidents. Some sections of the entire road are threatened by floods of average flood return period of 2.33 years. Provisions have been recommended for the road elevation keeping the HFL level keeping this threat in view. Implementation of the prescribed mitigation measures will minimize the adverse impacts. Moreover, the impacts shall be monitored continually by implementing and updating the Environmental Management Plan and Environmental Monitoring Plan.

467. During the construction stage, some trees along the road are likely to be cut but if the proposed compensatory afforestation plans are effectively implemented and survival rate is monitored and sustained, the positive benefits are likely to be accrued. Many old trees are located along the project road. These trees play vital role for the environmental conditions of the area. Efforts are proposed to minimize cutting of these trees with suitable modifications in the road alignment/widening options. However, there are no legislative restrictions in cutting these trees. There are no other environmental sensitive resources found in the project area, which is likely to be affected due to the project.

468. The project is welcomed by all the stakeholders and received immense support from local people. The local people appreciated that besides providing an all-weather efficient connectivity to large rural populations and improving the traffic scenario in the region, it will bear out several other socio-economic positive benefits. The suggestions received from the public/stakeholders have been integrated while developing the mitigation measures and Environmental Management and Monitoring Plan.

469. During the construction stage more then 100 awareness campaign programme held in the community people, student of the schools colleges and the rural community to aware Health, Safety and Environmental issues. In the Hatikamrul-Rangpur road.

Image 14: Awareness campaign programme at the school

Image 15: Awareness campaign programme at the community people

470. During the construction stage more then 120 training programme held in the construction workers, Engineers, Environmental Management officers, Health and Safety personals to aware Health, Safety and Environmental issues.

Image 16: Training programme with the Engineers and EHS personals

Image 17: Training programme with the construction working woman at base camp

471. During various loan and safeguard review missions of ADB, they gave recommendations and comments on Environment, Health and Safety issues and follow up accordingly.

Image 17: ADB personals visit the sites, December 29, 2022

Image 18: ADB Field Mission, 5th-6th June'2022

472. During the construction stage since May 2017, more than 10 Semiannual Environmental Monitoring Report (SEMR) have been submitted to the ADB. These EMRs reflected the environmental scenario of the project during the construction period. Every three months environmental tests for air quality, water quality and noise level have been carried out which provides quantitative results of the environmental conditions of the project. Any results obtained beyond the standards have been analysed and relevant mitigation measures have been taken to bring back the parameters within standard to prevent environmental degradation.

Image 19: Air quality monitoring, December 19, 2022

Image 20: Noise level monitoring, December 19, 2022

473. During the construction phase, PIU and CSC have posted Green tag at the work sites construction area, so that employees of contractors may easily identify compliant vehicles and machineries to ensure safe and environment friendly.

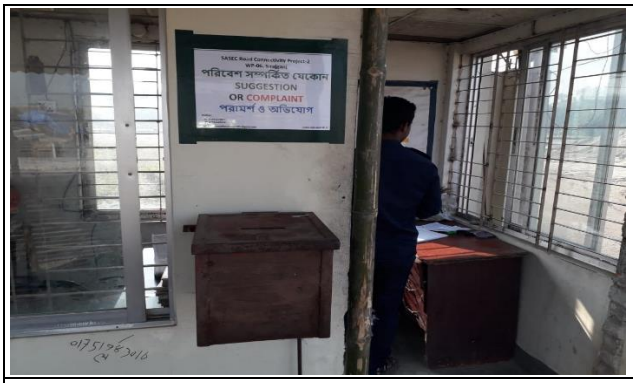

Image 21: Environmental grievance box at the construction area

Image 22: Implemented Green tag at the construction area

D. Post IEE Surveillance and Monitoring

474. While an IEE is meant to provide a comprehensive understanding of the environment status of the area under the study, post IEE surveillance is the means to ensure that the significant impacts identified are adequately mitigated as per the proposed mitigation plan. A detailed monitoring plan has been provided as part of the Environmental Management Plan.

475. Environmental impact and compliance monitoring activities focus on compliance with conditions of licenses from DOE and EMP provisions, recording implementation of mitigation measures, recording environmental parameters, reviewing contractor environmental performance, and proposing remedial actions to address unexpected impacts and complaints.

476. The EMP prepared for the project (Chapter 6) will be used as basis for an environmental compliance program in a regular program of environmental monitoring and auditing. In addition, any conditions included as part of the environmental compliance certificate from the government (MOEF/DOE) will also be included as a basis for environmental monitoring and compliance. Therefore, monitoring of (i) the implementation of mitigation measures and (ii) the implementation of the conditions of environmental compliance will be carried out regularly as scheduled in the EMP, and results will be reported semi-annually to ADB and DOE.

E. Recommendations

477. The EMP, its mitigation and monitoring programs, contained herewith have been included within the Bidding documents for project works. The Bid documents state that the contractor is responsible for the implementation of the requirements of the EMP through his own Site Specific Environmental Management Plan which adopts all of the conditions of the EMP and add site specific elements that are not currently known, such as the Contractors borrow pit locations. This ensures that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

478. The EMP and all its requirements have been added to the contractor's contract, thereby making implementation of the EMP a legal requirement according to the contract. Contractors then prepared their respective CEMP which have been approved and monitored by the Engineer/Environmental Specialist. To ensure compliance with the CEMP the contractor should employ an environmental monitoring officer to monitor and report project activities throughout the project construction phase.

479. RHD has social and environmental circle but they need capacity building and practical exposure. Adequate training shall be imparted as proposed under environmental management plan to enhance the capability of concerned EA officials. It is recommended to update environmental guidelines focused on effective implementation of mitigation measures. Performance indicators may also be developed as part of these guidelines to monitor and assess the effectiveness of the mitigation measures.

480. The Initial Environmental Examinations for the establishment of Research and Training Centre (RRTC) has been prepared by the Project Implementation Consultant (Supervision Consultant) and disclosed on September 2019 and the Environmental Assessment for Road Operations Unit (ROU) will be prepared by the Project Implementation Consultant (Supervision Consultant) after the detailed designs are prepared. For updating IEE, air quality, ground water quality, surface water quality, noise level are tested again December 2022 and compared to the Base line data and existing data which has no remarkable changes at all. The alignment as it is and the variation due to time, cost, bus bay etc. Therefore, the impact remains almost same some noise level are accelerated from the baseline data and for this acceleration the intervention also taken which is minimize the noise level. Again Public Consultations, Focus Group Discussions (FGDs), Government Officials, Non-government Organizations, Individual Local People have been conducted to update the IEE.

REFERENCES

Banglapedia, 2012. *National Encyclopedia of Bangladesh Online [Online].* Available at http://www.banglapedia.org (accessed on 15-04-2013)

Bangladesh Bureau of Statistics, 2006. *Population Census 2011*. [Online], Available at: http://www.bbs.gov.bd/home.aspx# (accessed on 15-04-2013)

Brammer, H., 1996. The Geography of the Soils of Bangladesh. Dhaka: University Press Limited. IPCC (Intergovernmental Panel on Climate Change), 2007. Climate change 2007: Synthesis Report. Contribution of Working Groups I, II, III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland.

International Union for Conservation of Nature (IUCN), 2002. *Bio-ecological zones of Bangladesh*. Dhaka: IUCN Bangladesh.

IUCN Bangladesh. ed. 2002f. *Bio-ecological Zones of Bangladesh.* Dhaka: IUCN-TheWorld Conservation Union.

MoEF, 2009. Bangladesh Climate Change Strategy and Action Plan 2009, Ministry of Environment and Forest, Bangladesh.

MoEF/UNDP, 2005. National Adaptation Programme on Action (NAPA). Final Report. Ministry of Environment and Forests, GOB, Bangladesh.

Morgan, J.P. and McIntyre, W.G., 1959.Quaternary Geology of the Bengal Basin, East Pakistan and India*. Bulletin of the Geological Society of America*, Vol 70, pp 319-342.

Rashid, H., 1977. Geography of Bangladesh. Dhaka: University Press Limited.

Soil Resource Development Institute (SRDI), 1997. *Physiography of Bangladesh*. Dhaka: SRDI, Ministry of Agriculture.

Soil Resource Development Institute (SRDI), 1998. *Agro-ecological regions of Bangladesh*. Dhaka: SRDI, Ministry of Agriculture.

United Nations Population Fund (UNFPA), 2010. *State of World Population 2010- From Conflict and Crisis to Renewal: generations of change* [Online]. Available at: http://www.unfpa.org/webdav/site/global/shared/swp/2010/swop_2010_eng.pdf (accessed on 15-04-2013)

Wahab, A., (2008), *Bangladesh Introduction (Ramsar Wetland Information).* [Online] Available at: http://ramsar.wetlands.org/Portals/15/Bangladesh.pdf (accessed on 15-04-2013)

Zahiruddin, S.A., 1993. *Bangladesh National Building Code*. Dhaka: Housing and Building Research Institute, Ministry of Housing and Public Works, Government of the People's Republic of Bangladesh.